ENGINEERING NEWS-RECORD

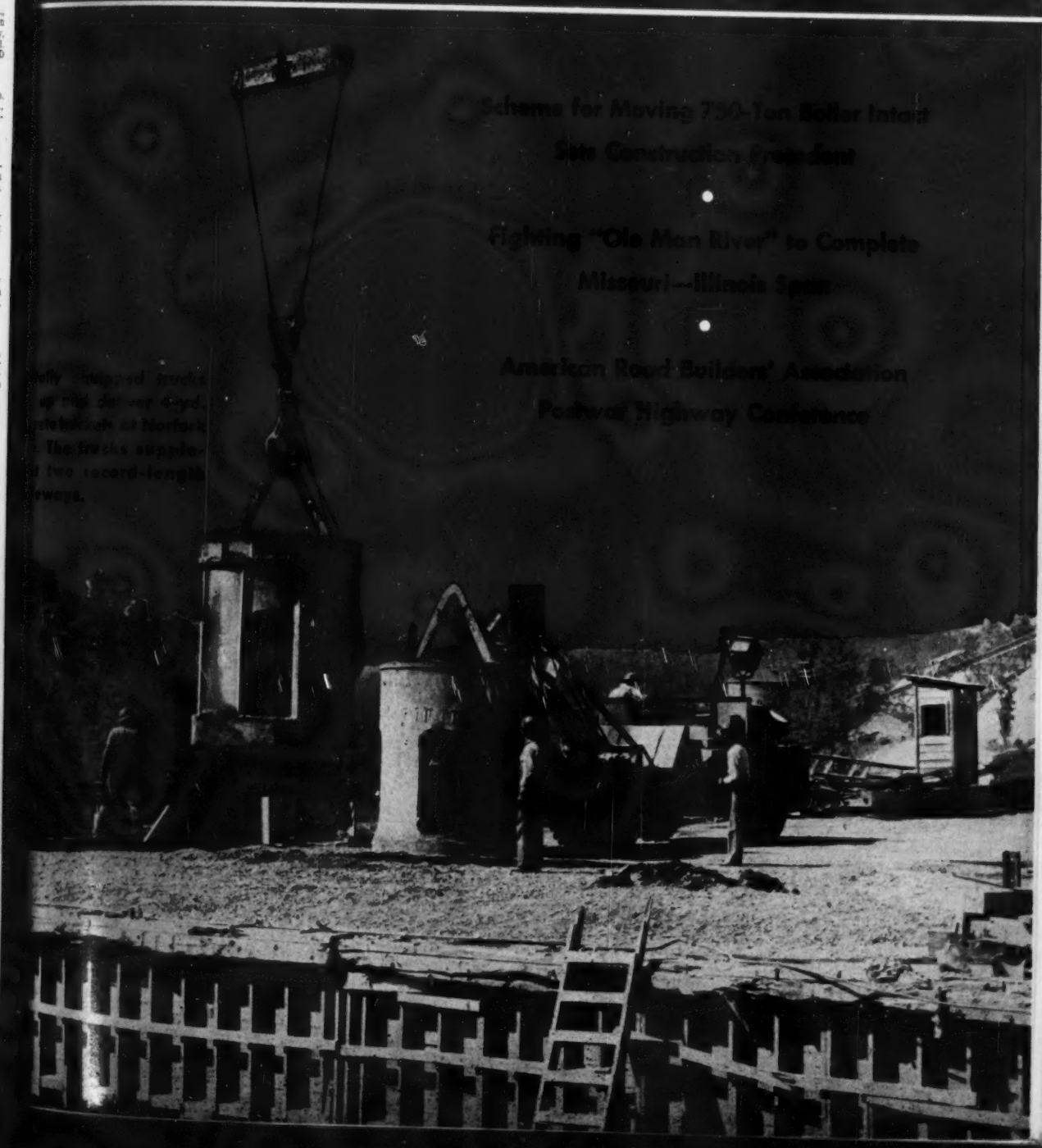
FEBRUARY 10, 1944

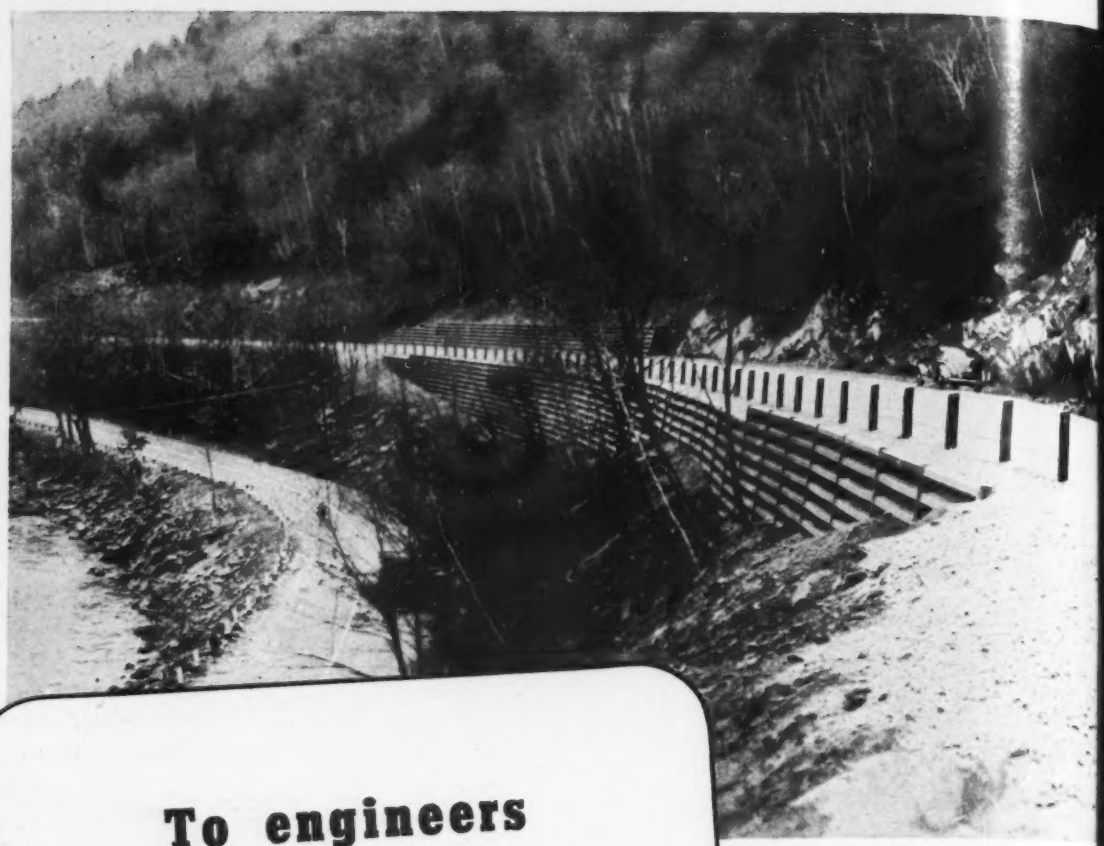
Scheme for Moving 730-Ton Boiler Intact

Safe Construction Precedent

Fighting "Ole Man River" to Complete Missouri—Illinois Span

American Road Builders' Association Postwar Highway Conference





A divided four-lane highway replaces t once narrow state route. Rugged Arm Bin-Type Walls stabilize the right-of-w which is so steep in places that the t pairs of lanes are separated by elevatio ranging to almost seventy feet.

To engineers who are planning the "BATTLE OF PEACE"

★ ★ ★

America will need your plans. Millions of fighting men and other millions of war workers must some day turn to new jobs in a new and different world. You can help by planning now to avert a serious let-down when Victory is won.

No doubt you are thinking about many projects that would not only improve roads and streets, but even more important would provide jobs for returning service men and workers now in war industries. Even now industry is planning post-war developments to absorb its share of these people. If federal, state and municipal governments have their plans ready, unemployment will be less of a problem to Americ

In this "board work" you m need a practical solution for u stable slopes, rights-of-way a similar problems. Remembe ARMCO Bin-Type Walls for the ability to overcome unequal sett ment without cracking or bulgi

So include ARMCO Walls in yo plans for the future even thou you can't get them for immedi construction. Right now tanks, gu and ships are most importa Armco Drainage Products Asso tion, 365 Curtis St., Middletown,

ARMCO

Bin-Type RETAINING WALL

CONSTRUCTION TRENDS

Notes on significant movements in the construction industry

Postwar Planning Progress in 1943

OF THE $5,101,087,000 in *proposed* postwar construction projects, engineers and architects were either at work on plans and specifications or had completed plans for projects totalling $1,647,960,000, according to reports to *Engineering News-Record* on postwar engineering construction progress up to the end of 1943.

It is these plans and specifications that are the true measure of postwar planning progress in the construction industry. They are 33 percent of the total *proposed* project volume reported during the past year.

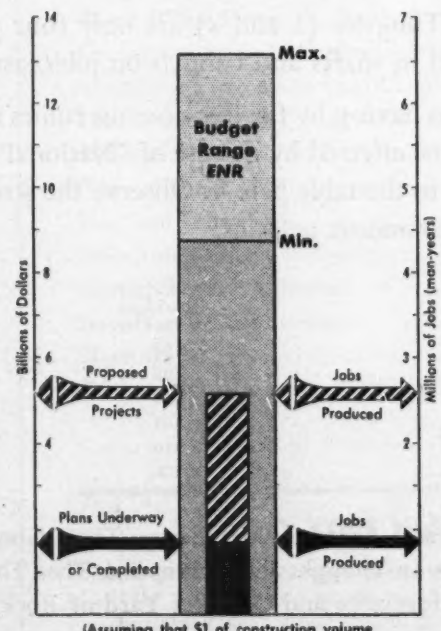
The backlog of *planned* projects is expected to produce 823,980 jobs for construction men in the postwar years. This anticipated employment figure is based on the assumption that one dollar of construction volume produces one man-hour of labor, and that construction labor works 2,000 hours per year. On the same basis, the *proposed* postwar project volume would provide 2,550,000 jobs if it all matures into planned projects.

Measuring the reported *planned* project volume against the *ENR* annual civil engineering construction budget reveals that *planned* work is 19 percent of the minimum construction budget, and 12½ percent of the maximum. The budget of annual civil engineering construction expected in the postwar period (*ENR*, Nov. 4, 1943; page 1), based on an assumed national income of $150,000,000,000 per year, ranges from a minimum of $8,700,000,000 to a maximum of $13,100,000,000.

POSTWAR CONSTRUCTION PROJECTS PROPOSED SHOWING VOLUME FOR WHICH PLANS ARE UNDER WAY OR COMPLETED

Status of postwar planning reported to *ENR* compared with annual postwar construction budget based on assumed National Income of $150,000,000,000 per year.

(Jan. 1, 1943 to Dec. 31, 1943)



(Assuming that $1 of construction volume produces 1 man-hour of labor)

The *proposed* postwar projects backlog accumulated during 1943 is 59 percent of one year's minimum budgeted volume, 39 percent of the maximum budgeted total. It represents a reservoir of engineered building projects, $1,333,698,000; highways, $1,256,898,000; bridges, $420,206,000; waterworks, $237,354,000; sewerage, $388,199,000; earthwork, $741,211,000; unclassified construction, $723,521,000.

Of the $1,647,960,000 in *planned* project volume, $316,711,000 is for engineered buildings — $284,947,000, public; $6,079,000, private industrial; and $25,685,000 for commercial building and large-scale private housing. Street and road projects total $509,134,000; bridges, $236,851,000; waterworks, $58,874,000; sewerage, $144,021,000; earthwork and drainage, $118,900,000; and unclassified construction, $263,469,000.

Overall "programs" exceed these totals, but the shelf of *planned* projects comes out of the *reservoir* of *proposed* projects and it is only the *planned* projects that produce jobs.

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SEMIGELATINS VS GELATINS
For Shaft and Tunnel

National Powder Company's Tungites (1 and 2) are only four years old but more than two million pounds have been used in shafts and tunnels on jobs east of the Mississippi.

These Tungites are semigelatins having by far less noxious fumes than the straight or ammonia gelatins. The savings that can be effected by the use of "National" Tungites for shaft or tunnel work are obvious by referring to the table below. Observe the strength and cartridge count as compared to nitroglycerine or ammonia gelatins.

	No. of 1¼ x 8 Cartridges Per 50 Lbs.	Weight Strength %	Bulk Strength %
40% Straight (Nitroglycerine) Gelatin	94	32.6	43
60% Straight (Nitroglycerine) Gelatin	98	51.8	60
40% Standard (Ammonia) Gelatin	94	31.8	42
60% Standard (Ammonia) Gelatin	101	51.7	55.5
Tungite No. 1 (Semigelatin)	110	65	53
Tungite No. 2 (Semigelatin)	120	65	48

These Tungites and Gelatins Are Better Than Good "Rockers". They Are So New in Thought and Conception That They Are Amazing in Their Performance and Cost Per Yard of Rock Loaded Out.

"NOT LIVING ON OUR REPUTATION BUT BUILDING IT."

NATIONAL POWDER COMPANY
ELDRED, McKEAN COUNTY **PENNSYLVANIA**

ENGINEERING NEWS-RECORD

oted to Buildings, Sewers, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Shipbuilding, Irrigation, Canals, Railroads

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JOHN ABBINK, *Publisher*

WALDO G. BOWMAN, *Editor* ALBERT E. PAXTON, *Manager*

Vol. 132 FEBRUARY 10, 1944 No. 6

COMING NEXT

"BUILDING UNDER FIRE"—the story of outstanding achievement by our fighting Marine, Army and Seabee engineers on foreign fields—will be only one of many interesting features of *ENR*'s 1943 REVIEW ISSUE coming Feb. 24. In this issue every phase of engineered construction at home will be covered. War-induced problems, such as those of postwar planning, engineering education and construction equipment supply have been singled out for emphasis. Our annual statistical review, which will encompass data on jobs proposed for postwar construction, will round out one of the most valuable and interesting Review Numbers of recent years.

LOOKING AHEAD

For engineers everywhere the accomplishments on the Ford Rubber Plantation in Brazil commands the greatest interest. To plan and execute the development of 2,000,000 acres—with accompanying housing, shops, communications, equipment and sanitary facilities—to establish a self-contained enterprise 500 miles up the Amazon basin, presented a task of major proportions. In the March 9 issue, Edward J. Cleary, *ENR*'s managing editor, reports on his visit to this unique undertaking.

Designing an airplane modification center to provide 624,000 sq.ft. of floor area in just three weeks and complete construction in 92 days is an achievement worthy of note. A building record was set because of the utmost care having been given to design factors and selection of materials that would promote rapid construction. The project will be described in an early issue.

Conversion of a ten-lane fixed bridge into a 28-ft. vertical lift span over Chicago's Sanitary and Ship Canal—to pass war craft from the Great Lakes to the Gulf—is a story of America's will to win; a construction story of a relentless fight against time and the elements. The project was carried to completion without interruption to street or river traffic. An early issue of *ENR* will carry a complete description of the job.

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Number of copies of this issue printed: 35,993

DO YOU WANT AN INDEX?

Due to the paper shortage, no index for the current volume (July-December, 1943) will be issued except to subscribers who ask for it. If you want a copy of the index please send in the coupon below.

Editor—Engineering News-Record
McGRAW-HILL PUBLISHING COMPANY
330 West 42d Street, New York 18, N. Y.
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New Inland Hi-Bond Reinforcing Bar in Stock

Shipment is Immediate

The new Inland Hi-Bond reinforcing bars in a complete range of sizes are now available from Ryerson stock. The scientific design of this new bar with its reversed double helical ribs provides vastly greater anchorage and bonding strength in keeping with the development of higher strength concrete. We believe the Hi-Bond bar will effect many improvements and economies for the construction industry.

For complete reinforcing and structural steel-service . . . Hi-Bond bars, spirals, wire mesh, building accessories and removable metal forms . . . for help in every phase of construction from estimates to final delivery . . . call Ryerson.

We will be glad to receive your blue prints, furnish lump sum prices, and send you preliminary data on the new bar.

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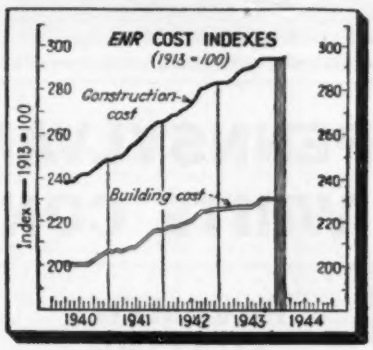
REINFORCING-SERVICE

MONTHLY CONSTRUCTION BUSINESS SUMMARY

ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

(,000 omitted)	January 1943 (4 wk.)	January 1944 (4 wk.)	% Change	Dec. 1943 (5 wk.)	Jan. 1944 (4 wk.)	% Change†
Continental U. S. Construction	$226,826	$156,518	−31.0	$176,460	$156,518	+11.0
Private Construction	15,498	24,356	+57.0	41,199	24,356	−26.0
Public Construction	211,328	132,162	−37.0	135,261	132,162	+22.0
Federal	199,256	124,597	−37.0	124,614	124,597	+25.0
Total New Productive Capital	$4,498	$147,172	+3180.0	$7,976	$147,172	+1748.0
Private Investment	2,998	52,265	+1642.0	7,476	52,265	+600.0
Federal (non-federal work)	1,500	4,075	+172.0	500	4,075	+715.0
Federal (federal work)	.....	90,832	.....	.....	90,832	.....
ENR Construction Volume Index, 1913 = 100	172	114	+34.0	103	114	+11.0

† *Adjusted for difference in number of weeks reported.*



CONSTRUCTION COSTS . . . . WAGE RATES . . . . MATERIAL PRICES

	February 1943	February 1944	% Change	Changes January to February 1943 Jan.	1943 Feb.	1943 %	1944 Jan.	1944 Feb.	1944 %
ENR Construction Cost Index, 1913 = 100‡	283.48	295.05	+4.1	283.45	283.48	**	294.57	295.05	+0.2
ENR Building Cost Index, 1913 = 100‡	226.90	232.03	+2.3	226.87	226.90	**	231.55	232.03	+0.2

‡ *Does not reflect increased costs due to more overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$0.832	$0.869	+4.4	$0.832	$0.832	0	$0.869	$0.869	0
Skilled Labor (Av. 3 trades)	1.606	1.620	+0.9	1.606	1.606	0	1.620	1.620	0
Bricklayers	1.700	1.715	+0.9	1.700	1.700	0	1.715	1.715	0
Structural Ironworkers	1.661	1.673	+0.7	1.661	1.661	0	1.673	1.673	0
Carpenters	1.457	1.472	+1.0	1.457	1.457	0	1.472	1.472	0
Cement, per bbl.	$2.60	$2.62	+0.8	$2.60	$2.60	0	$2.62	$2.62	0
Reinforcing steel, cwt.	2.70	2.79	+3.3	2.70	2.70	0	2.79	2.79	0
Structural steel, base	2.10	2.10	0	2.10	2.10	0	2.10	2.10	0
Sand, per ton	1.21	1.23	+1.7	1.21	1.21	0	1.23	1.23	0
Lumber, 2x4 Fir, per M ft.	51.47	53.45	+3.9	51.47	51.47	0	53.32	53.45	+0.2
Lumber, 2x4 Pine, per M ft.	44.03	49.71	+12.9	43.97	44.03	+0.1	48.96	49.71	+1.5
Brick, common, per M	15.66	16.20	+3.4	15.66	15.66	0	16.25	16.20	−0.3
Ready-mixed concrete, c.y.	7.39	7.42	+0.4	7.38	7.39	+0.1	7.42	7.42	0
Struct. clay tile, 3.12x12-in.	78.93	79.34	+0.5	78.93	78.93	0	79.34	79.34	0
Paving asphalt, cars, ton	14.88	15.25	+2.5	14.88	14.88	0	15.25	15.25	0

** *Less than .05 percent change.*

ENR INDEX NUMBERS

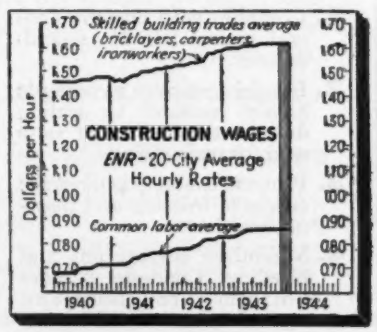
Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1926	Building Cost 1926	Volume '13	Volume '26
Feb., 1944	295.05	141.83	232.03	125.43	.....	.....
Jan., 1944	294.57	141.60	231.55	125.17	114	50
Dec., 1943	294.51	141.57	231.49	125.14	103	45
Nov., 1943	294.41	141.52	231.39	125.08	149	65
Oct., 1943	294.31	141.47	231.29	125.03	142	62
Sept., 1943	294.09	141.37	231.20	124.98	155	68
Aug., 1943	291.38	140.07	228.49	123.51	119	52
July, 1943	289.92	139.36	227.89	123.19	175	77
June, 1943	289.94	139.37	227.71	123.09	204	89
May, 1943	289.87	139.34	227.64	123.06	205	89
April, 1943	288.80	138.83	227.50	122.98	225	99
Mar., 1943	285.24	137.11	226.66	122.53	228	100
Feb., 1943	283.48	136.27	226.90	122.66	231	101
Jan., 1943	283.45	136.25	226.87	122.64	172	76
1943 (Av.)	289.05	139.83	228.75	123.66	176	77
1942 (Av.)	276.31	132.82	222.39	120.22	553	243
1941 (Av.)	257.84	123.95	211.46	114.32	375	164
1940 (Av.)	241.96	116.31	202.81	109.64	269	118

MATERIAL SHIPMENTS . . . . BUILDING PERMITS

	January 1943	January 1944	% Change	Dec. 1943	% Change Dec.-Jan.
Steel (% operating capacity) A. I. S. I.	97.5	98.5	+1.0	94.5	+4.2

	December 1942	December 1943	% Change	Twelve Months 1942	Twelve Months 1943	% Change
Fabricated structural steel, tons, A. I. S. C.	145,280*	39,633*	.....	2,039,966*	831,836*	.....
Cement, thous. bbl., U. S. B. of M.	8,955	5,603	−37.4	185,267	127,567	−31.2
Building Permits, 215 cities, Dun & Bradstreet (,000 omitted)	$38,847	$42,393	+9.1	$797,223	$509,115	−36.1

* *A. I. S. C. data on revised basis; '43 reports show actual bridge and building steel shipments; '42 on estimated tonnage of entire industry; figures are not comparable.*



COST OF LIVING INDEXES . . . . EMPLOYMENT

	December 1942	December 1943	% Change	Nov. 1943	% Change Nov.-Dec.
Cost of Living Index, N. I. C. B.	101.1	103.9	+2.8	103.7	+0.2
Rent (Housing) Index, N. I. C. B.	90.8	90.8	0	90.8	0
Total Employment (est.), thous., B. L. S.	38,942	38,335	−1.5	38,292	+0.1
Constr. Employment (est.), thous., B. L. S.	1,674	753	−55.0	871	−13.6

ENGINEERING CONSTRUCTION CONTRACTS—ENGINEERING NEWS-RECORD—JANUARY, 1944

Engineering News-Record *reports continental U. S. Construction projects of the following minimum cost—waterworks, excavation, drainage and irrigation,* $15,000 *other public works,* $25,000; *industrial buildings,* $40,000; *other buildings,* $150,000

Four Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States January 1944	United States January 1943	Canada
Public Works									
Waterworks	31	86	698	191	207	205	1,418	4,484	.....
Sewerage	421	86	280	462	719	269	2,237	2,643	.....
Bridges, public	25	9	547	.....	.....	157	738	1,971	.....
Earthwork and waterways	93	486	513	431	990	602	3,115	1,388	73
Streets and roads	20	400	1,239	375	450	2,233	4,717	16,486	187
Buildings, public	1,079	9,071	6,571	6,066	2,665	66,467	91,919	138,768	.....
Unclassified, public	1,283	6,398	5,740	1,114	9,162	4,321	28,018	45,588	280
Total public	2,952	16,536	15,588	8,639	14,193	74,254	132,162	211,328	540
Federal government (included in above classifications)	2,795	15,275	13,533	7,551	13,144	72,299	124,597	199,256	.....
Private									
Bridges, private	29	.....	65	750	.....	.....	844	1,500	.....
Industrial buildings	935	212	440	1,622	815	430	4,454	4,942	555
Commercial buildings	350	2,762	630	1,225	5,050	8,315	18,332	8,374	300
Unclassified, private	40	26	51	100	438	71	726	682	.....
Total private	1,354	3,000	1,186	3,697	6,303	8,816	24,356	15,498	855
Total Engineering Construction:									
January, 1944—4 weeks	4,306	19,536	16,774	12,336	20,496	83,070	$156,518	.....	1,404
December, 1943—5 weeks	6,991	26,584	31,472	24,676	41,531	45,206	176,460	.....	7,070
January, 1943—4 weeks	12,279	23,470	60,517	8,888	65,323	56,349	.....	226,826	9,531

CONCRETE HIGHWAY NEWS

Universal Atlas Cement Company (United States Steel Corporation Subsidiary)
Chrysler Building, New York 17, N. Y.

OFFICES: New York, Chicago, Albany, Boston, Philadelphia, Pittsburgh, Minneapolis, Duluth, Cleveland, St. Louis, Kansas City, Des Moines, Birmingham, Wa

PENNSYLVANIA ADDS MORE MILES OF WHITE CONCRETE REFLECTING CURB

PAVEMENT SCALING SOLVED

Tests prove scale-resistance of Atlas Duraplastic air-entraining portland cement

PAVEMENTS made with Atlas *Duraplastic*, which are practically scale-free after more than four years of street and highway service, have proved the value of Universal Atlas original research which developed Atlas *Duraplastic* air-entraining portland cement.

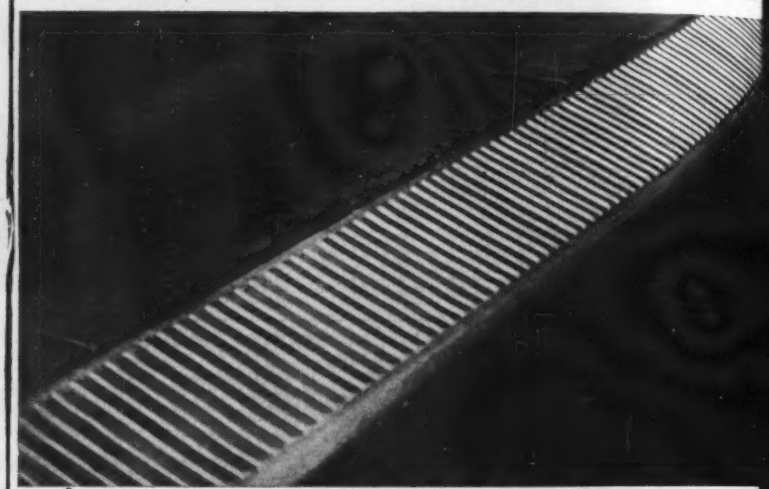
Quick Facts about Atlas Duraplastic

1. Complies with current Federal and A.S.T.M. specifications.
2. Renders concrete pavements highly resistant to scaling due to the action of salts used for ice removal.
3. Protects concrete against the effects of freezing and thawing weather.
4. Minimizes segregation and bleeding. Concrete is more uniform throughout and more durable.
5. Permits earlier finishing.
6. Requires no additional materials at the mixer.
7. Called *Duraplastic* because it makes concrete more *durable* and more *plastic*.

Our Technical Service Bureau will be glad to send you detailed information on Atlas Duraplastic, a product backed by more than six years of research and tests. Ask for reprints from trade and technical magazines which report the original research and the results of actual installations.

ENR-CD-1

Night driving hazards reduced with ATLAS WHITE CEMENT



White Concrete Reflecting Curb on Essington Avenue, Philadelphia. General Contractor, Union Paving Co., Philadelphia; Curb Contractor, Frapaul Construction Co. Inc., Hackensack, N. J. Part of 62,000 feet of White Concrete Reflecting Curb now in place or under contract. 70,600 additional feet planned for early installation. Car headlights alone illuminate the curb in this picture, showing how it forms a white guide to safety for night driving.

To cut down hazards of night driving—especially on rainy nights when visibility is almost nil—Pennsylvania is adding miles of White Concrete Reflecting Curb on important highways.

This Curb, made with Atlas White cement, is an effective safety measure for two reasons: it is a good reflector because it is white; it is highly visible because its scientifically designed projecting faces catch headlight beams and reflect them in the right direction—back to the driver's eyes. The diagrams below show why.

Rain actually increases the curb's reflective value, for a water film turns the reflecting faces into even better "mirrors" that show the way far ahead.

Before planning new highways or improving present ones, write to our Atlas White Bureau for full information on White Concrete Reflecting Curb. Ask for a copy of the book "A White Guide to Safety."

A smooth curb (left) wastes light . . . reflects it up and away from the driver. A White Concrete Reflecting Curb (right) conserves light . . . reflects it back to the driver. A smooth curb is barely visible at night; a White Concrete Reflecting Curb stands out—bright and clear.

UNIVERSAL ATLAS CEMENTS

UNIVERSAL PORTLAND • ATLAS PORTLAND • ATLAS WHITE • ATLAS DURAPLASTIC • ATLAS HIGH-EARL

ENGINEERING NEWS-RECORD • FEBRUARY 10, 1944 • VOLUME 132 • NUMBER 6

Roadbuilders stress need for accelerated planning

High government officials and representatives of roadbuilding and construction industries study means for increasing the tempo of postwar planning

Experts in roadbuilding and public works construction pulled no punches at the American Road Builders Association's annual meeting, held in Chicago, Feb. 1-3, when they warned that postwar planning must be shifted into high gear if adequate construction plans are to be made ready for demobilization day. The 906 delegates to the three-day conference delved into the orderly and equitable disposal of surplus government-owned construction equipment after the war, federal aid for city and county street and road construction, and postwar highway financing.

Postwar program a myth?

Those in the audience who might have assumed, from previous talks, that a postwar construction program was all set were brought up with a start by Col. William N. Carey, chief engineer of the Federal Works Agency, who bluntly stated at the outset of an excellent talk: "Except for a small but growing highway program, there just isn't any postwar public works program. It is in the period of gestation but it hasn't yet been born. Its birth is long overdue and I hope there is a doctor or many doctors in the audience, not of medicine but of public works, who will take steps in the home community to hasten the overdue birth of a national public-works program for use after the war." Col. Carey deplored the widespread belief that some place in Washington there exists a shelf of public works which can be turned to the minute the war ends.

Projects only listed

It is true, he said, that public officials generally throughout the country have developed a list of public works believed necessary or desirable for their respective communities. To these lists is usually attached a horseback estimate of costs in boxcar figures which look most impressive in print but with very few exceptions that is about as far as our much talked of and much publicized national program of local public works has progressed. To date, no central government agency has been authorized to do even so much as to collect these lists of local projects, to say nothing of stimulating and correlating the preparation of actual plans and contract documents necessary to translate these dreams into actual structures. A few cities and still fewer states Col. Carey said are embarked now on the engineering, architectural and legal labor required between the project dream stage and the blueprint stage.

In discussing why "a mountain of talk about postwar construction programs has brought forth only a mouse of working plans and specifications," Col. Carey said that many municipalities which have the money available now to pay for plans are hesitating in order to see what Congress is going to do about postwar public works. Those local public officials who expect outright federal grants for public-works planning will, in Col. Carey's opinion, be disappointed.

No justification for delays

There is little justification he went on to say, for most local government units to wait another day. The sooner working plans and contract documents are completed for needed projects the sooner we will create a national reservoir of public works. Only when that reservoir is full can we be sure that there will be jobs at living wages for men who will surely need them when the war is over. He also stressed the desirability of planning for only needed

(*Continued on following page*)

Oil projects announced for Middle East area

Extensive American construction operations in the Middle East are assured in the near future, following announcements last week relating to oil development projects planned for the Persian Gulf area. The Arabian-American Oil Co., jointly owned by Standard Oil Co. of California and the Texas Corp., and holding a large development concession from the government of Saudi Arabia, will build a new refinery on the mainland, as well as enlarging its existing refinery on Bahrein Island. Then, to make the products of these plants, as well as those of the Gulf Oil Co.'s refinery in nearby Kuwait available in the Mediterranean, the Petroleum Reserves Corp., subsidiary of RFC, will build an 800-mile pipeline from the Persian Gulf area to an undisclosed Mediterranean port. Estimated cost of the pipeline is 130 to 165 million dollars. It will be government financed, but its cost will be amortized over a 25-year period by the oil companies.

In making the announcements, Secretary of the Interior Harold L. Ickes, who is also president of PRC, stated that the pipeline "will serve an essential military purpose, and will also be of lasting benefit to the people of this nation". He disclosed that the oil companies will set aside for the United States a crude oil reserve of 1 billion barrels, or 20 percent of the total draw if it should prove less than 5 billion barrels. This oil will be made available to the government for military or naval use at 25 percent below the market price.

Although oil interests have opposed the Petroleum Reserves Corp. and have sought to have it abandoned, these announcements are believed to indicate that a basis of cooperation has been worked out.

Mr. Ickes also revealed that the British-owned Anglo-Iranian Oil Co. has enlarged its refinery at Abadan, Iran, and that Consolidated Refineries Ltd. is increasing the capacity of its refinery at Haifa, Palestine, by 350,000 bbl. a day.

public works, projects needed now or within the next few years so urgently that they would have to be built by the local communities even if there should be no federal help.

A.R.B.A. Postwar plan

The American Road Builders Association postwar highway plan calling for expenditures of $3 billion per year was outlined by Charles M. Upham, engineer-director of the association and Carl W. Brown, president. The plan breaks the recommended expenditures down into the following classes: State highway systems, $1,100,000,000; metropolitan area highway, $1,000,000,000; city streets, $500,000,000; and county and local roads, $400,000,000. Mr. Upham declared this is not a plan to create jobs, but is one to meet actual and urgent road and street needs. In meeting those needs, he said, large numbers of jobs will be available.

Mr. Upham believes that the plan can be placed in effect as soon as needed, and for hundreds of thousands of men returning from the armed forces it will provide a natural outlet for their training and ability. He declared in the final analysis the plan is an insurance against the return of WPA or some similar agency for relief work and a depression of long duration.

Program declared sound

President Brown said the A.R.B.A. is in a position of leadership today for the simple reason that it has mapped out a postwar program, one that is sound, practical and is meeting approval by civic, business and governmental leaders. The problem now, he said, is largely that of selling, of extending knowledge of the plan, and of winning the action and support of legislative and administrative bodies. The most striking feature of the plan, according to Mr. Brown, is that it is a national program which can be and must be participated in by all highway agencies, federal, state, county, city and local, therefore has a wide appeal.

A campaign to promote the program will be carried on through chambers of commerce, civic clubs, business and trade groups as well as by the highway industry. He warned that the final success of the plan depends upon how much effort the highway industry puts behind it. Despite drop in revenues from highway taxes, Mr. Brown believes every community should first look to its own resources in financing postwar work. He urges all public agencies to speed up preparation of final blueprints, for if we come out of this war with a large stockpile of projects all set to go we have the best insurance against another WPA program.

Two relatively simple yet greatly needed types of highway improvement —widening existing concrete pavement and resurfacing of damaged road surfaces—can well be employed to provide large-scale employment without the necessity of preparing detailed plans, according to S. C. Hadden, chairman of the Indiana State Highway Commission and president of the American Association of State Highway Officials. Citing Indiana's need for such improvements, he asserted that more than 2,000 mi. of the state's existing 18-ft. wide, or narrower, pavement needs widening to at least 22 ft. and preferably to 24 ft. Estimating this work to cost $6,000 per mi., the entire program would call for an expenditure of $12,000,000, most of which needs relatively few plans other than the original plan and profile drawings.

Resurfacing required

In addition to pavement widening, a large amount of resurfacing is needed, said Mr. Hadden, and highway departments can do a great deal of this timely work while preparing design plans for postwar construction. It can be considered an anchor to windward, or a reserve of work in the immediate postwar highway program, he said.

Highway officials, in general, are content to go along with the PRA and other governmental agencies connected with roadbuilding, asserted Mr. Hadden, but it is a deplorable fact that governmental approval must be secured on so many small construction jobs. He urged the assembled roadbuilders to give their support to securing further clarification of the War Production Board's conservation order L-41 (*ENR* Nov. 11, p. 723) which would enable highway maintenance and reconstruction to be performed without first securing governmental approval. This move also should include small construction projects, he said.

Cities need help

Highway officials and other road planners must remain flexible in their thinking and friendly in their relations to other roadbuilding agencies, asserted Mr. Hadden. Cities now clamor for attention and their desperate need for street and highway improvement demands early and sympathetic attention. "They have waited 20 years while we have developed vast rural highway systems and now many of us agree with them that some provision should be made for dividing roadbuilding funds between the cities and states," he said.

Federal action urged

Mr. Hadden urged the conference to strive for the earliest possible enactment of the best obtainable federal legislation covering highway construction. Much confusion, he said, results from the fact that the amount of federal roadbuilding funds to be made available, or under what conditions they are to be expended are not now known. The methods of state matching of federal funds also looms as a serious problem, he declared. Revenues from gasoline tax have been sharply reduced and many trucks and automobiles are getting too old for further use. These two factors, together with large maintenance programs now made necessary by excessive wartime traffic loads, all may leave the highway departments with little matching money by the end of this year. A recent survey of several state highway departments disclosed only two who felt they could match federal appropriations on the old 50-50 basis, concluded Mr. Hadden.

Traffic dictates road planning

In outlining the report of the National Interregional Highway Committee presented to Congress by the President Jan. 12 (*ENR* Jan. 27, 1944 p. 144) H. E. Hilts, deputy commissioner, Public Roads Administration, stressed the fact that volume of traffic would largely dictate the postwar road program. In order to fulfill the financial requirements of a continuing program, assurance must be reasonably certain that roads when added to a plan system will by service rendered to the general public be self-supporting. If they are not self-supporting in terms of revenues obtained from gas taxes and other motor vehicle imposts from the vehicles which use them directly they will, in fact, be subsidized from revenues obtained through the use of the heavily traveled arteries or from other general revenues. Thus all road projects are considered as separate self-supporting projects. If they are to be subsidized they should show other general utility benefits which make them desirable as feeders to more important roads. We are now passing through a period, he declared, which tests the ability of other projects to pay their way, and prudence dictates a reasonable economic approach to the financing of a postwar program.

Three major classifications of road and bridge projects will be represented on a postwar program, Mr. Hilts pointed out. These are projects on the federal-aid secondary systems, the federal-aid primary system, and on that part of the primary system that may be indicated as the inter-regional system. He called particular attention to the secondary or rural-road program which provides opportunity for highway officials to join with agricultural experts

(*Continued on page* 58)

Prisoners-of-war labor available for use on public works construction

Texas sanitation group is informed that good results are obtained by war prisoners hired from the army at prevailing rates of pay. Funds subscribed for a Texas Sanitary Foundation

Public works construction with Ger- and Italian prisoners of war is be- successfully carried out in several as cities where manpower short- s exist, according to Brig. Gen. L. Guerre, director of the internal se- ity division of the 8th Service Com- nd. In an address before the Texas ter Works and Sewerage Short ool, meeting at College Station Jan. Feb. 2, he urged municipal and sani- on engineers to make use of this ervoir of manpower on public works jects.

However, said General Guerre, pris- r-of-war labor is not "cheap" labor ause it is mandatory that the pre- ling wage scale be paid by the user. e army supplies the guards, the ps and the maintenance for the pris- rs but the municipality must furnish hnical supervision of the work. ge totals at the prevailing local scale paid directly to the army which, turn, compensates the prisoners at rate of 80 cents a day. Eventually municipality is reimbursed an unt not exceeding 5 percent of the l payment for expenses resulting n special training or supervision of or gangs.

Prisoner-of-war procedure

o apply for prisoner-of-war labor, , county or private contractors uld contact the nearest War Man- er Commission office for forms on ch certify that no "free" labor is ilable and set forth the prevailing e rates in the locality. These forms uld then be filed with the Internal urity Division of the Service Com- nd in which the project is located.

While there are no restrictions as locations of work, said General erre, the army will not establish porary prisoner camps for less than men. Incidentally, the contracting cy must assume the cost and pro- facilities for transporting the kers from these camps (usually ted in abandoned warehouses or C camps) to the site of the project. y assurance was given that, despite spaper accounts to the contrary, prisoners are adequately guarded may even be used on projects in crowded business districts of cities. killed technicians are not available, the quality of the common labor was said to be excellent, particularly that employed on masonry and concrete finishing operations.

Ehlers proposes foundation

Stating that the fundamental basis for improved standards of health and sanitation lies in a strong educational program, V. M. Ehlers, state sanitary engineer of the Texas department of health, urged the establishment of a "Sanitary Foundation" as a prime objective for postwar planning.

Mr. Ehlers visualized the Foundation as an enterprise supported by men in the state who were engaged in sanitation endeavors, supplemented with funds obtainable from city, county, state and federal sources. Housed in an appropriate building equipped with research facilities, a library, and full-time personnel, the Foundation would be prepared to serve as a center for training purposes and servicing sanitary educational needs. He would even go so far as to provide here the organizational facilities for coordinating the training of Latin American engineers.

This plan was received with so much enthusiasm that War Bond pledges totalling several hundreds of dollars were made by individuals from the floor of the assembly hall. The subscriptions were inaugurated by a pledge from Col. Harold W. Keller, chief of the Repairs and Utilities Branch, Corps of Engineers, 8th Service Command, who took this opportunity "to make a token" of his appreciation of the help that he had received in Texas on camp sanitation programs. Dozens of pledges were received from waterworks and sewage plant operators in the state as well as from two students—one from Brazil and one from Venezuela.

Texas joins Federation

Sentiment for strengthening sanitation services in the state was evidenced also by the adoption of a resolution and constitution leading to the establishment of a sewage works association affiliated with the Federation of Sewage Works Associations. This action was taken following an address by W. H. Wisely, executive-secretary of the Federation, who outlined the advantages of affiliation with a national organization.

The extent of water borne diseases in South America was outlined by Maj. A. E. Williamson, of the Office of the Coordinator of Inter American Affairs, who said that in the 18 countries where the United States is engaged in cooperative health and sanitation work water borne diseases ranked fourth or better in importance on the basis of mortality rates. Only malaria could be credited with taking a greater overall toll.

South American Sanitation

Vital statistics in Latin America are not accurate, stated Major Williamson but what is available may be considered as under-estimates because there are many deficiencies in present reporting methods. These statistics show a mortality rate of 55 per 100,000 from diarrhea and enteritis alone. In Santiago, Chile, where sewage irrigation is widely practiced, the typhoid rate was said to reach 30 per 100,000; in contrast to this the typhoid rates in two of the large cities of the United States was cited as 0.4 and 0.8 per 100,000.

Higher standards of living could not be achieved, he said, until water borne diseases were curbed. At the present time the Coordinator's Office has under construction 14 water supply projects; 12 of these are in Central America through which the Inter-American Highway is being built, and 2 are in South America.

Other phases of the challenging problems of sanitation in Latin America were presented in an illustrated talk by Edward J. Cleary, managing editor of *Engineering News-Record*.

Sanitary Corps activities

The functions of the Sanitary Corps of the army are akin to those of a state health department in its relations with agencies that design, construct and operate facilities for the conservation of health said Col. W. A. Hardenbergh, chief of the sanitary engineering division, Surgeon-General's office. The corps advises, recommends and otherwise provides technical supervision of projects built by the Corps of Engineers and operated by the Medical Corps.

Col. Hardenbergh revealed that the Corps—manned only by commissioned officers—has a total complement of 2,350, of which 1,900 have been added since the war started; the Corps has no permanent status during peacetime. The total personnel at present includes 800 sanitary engineers, 200 entomologists, 800 laboratory technicians and 550 statistician and supply officers.

Elected to succeed Roy Matthews, utilities superintendent, Albany, Tex., as president of the Texas Water Works and Sewerage Short School for the coming year was Walter Hicks, city engineer of Paris, Tex. Registration at this 26th meeting was over 400.

Moreell is nominated for vice admiral rank

President Roosevelt has nominated Rear Admiral Moreell, chief of the Bureau of Yards and Docks, for promotion to vice admiral, subject to confirmation by the Senate. Two other bureau chiefs were similarly nominated at the same time, leading to speculation on whether this is the first step in a plan to raise all heads of Navy bureaus to vice admiral rank. Such a move, it is believed in Washington, would meet with some opposition on the ground that it might injure the morals of officers on sea duty. Question has also been raised as to whether promotion to such rank is legally possible under existing Army and Navy rulings. The Senate Naval Affairs Committee is reported to be looking into these questions.

Rear Admiral Ben Moreell

Admiral Moreell, who was appointed chief of the Bureau of Yards and Docks in 1937, and reappointed in 1941, is generally acknowledged to have handled one of the most difficult top military jobs in the war with outstanding efficiency and success. A Civil Engineer Corps officer since 1917, when he entered the Navy from civilian life four years after graduation from Washington University, St. Louis, he had wide experience in the Bureau of Yards and Docks before becoming its chief. In 1918 and 1919 he was in the Azores, and then for four years in Haiti. In 1926, as assistant design manager of the Bureau, he wrote a manual on concrete design, which is still considered one of the best treatises available on the subject. Later, he spent a year in France studying concrete design methods used there. He has been public works officer at the Puget Sound Navy yard at Seattle and also at Pearl Harbor. It was from the latter post, when he was a commander in rank, that he was recalled to assume charge of the Bureau in Washington. Under his supervision the Bureau has carried out seven billion dollars worth of construction work (compared to only a 184 million total in the last war) and has expanded its personnel many times, not including the nearly 300,000 Seabees whose addition to the Navy is credited to Admiral Moreell. Admiral Moreell is an honorary member of the American Society of Civil Engineers, a past president of the American Concrete Institute and has received numerous awards for his engineering and construction achievements.

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New water supply system proposed for New Jersey

Plans for the construction of a $50,000,000 high-level water supply system, which would be the largest in New Jersey to furnish 225,000,000 gallons of potable water daily to northern New Jersey have been presented to Gov. Walter E. Edge of that state. This is not a new proposal.

Emerson L. Richards, former Atlantic County senator, who had been delegated by Governor Edge to survey the water situation in North Jersey, said the plans drawn up by him and engineers call for the construction of a huge storage reservoir along the south branch of the Raritan River in Hunterdon and Morris counties. An intercepting reservoir would be in the Watchung Mountains.

The new watershed would supplement the supplies of eight counties, Mr. Richards asserted. The water would be available to all of Bergen, Essex, Hudson and Passaic counties, most of Union, the eastern parts of Somerset and Morris and the northern part of Middlesex County.

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British builders report on U. S. mission

The British Building Mission in North America (*ENR*, July 29, '43, p. 179 and Oct. 14, '43, p. 569) made its report to Parliament on Feb. 5. Lord Portal, Minister of Works and Planning, in reporting on the mission's findings, said that the acute housing shortage that will face Great Britain after the war probably will be solved by the erection of thousands of prefabricated dwellings, perhaps of American design, good for about ten years.

Crushed stone group meets in New York

The National Crushed Stone Association, at its annual meeting in New York last week, mixed technical talks with business forecasts and problems, and elected new officers.

Edward W. Bauman, formerly chief of the non-metallic section, mining division of the War Production Board was introduced to the association as a newly appointed field engineer. His work is to assist in the field in solving technical problems of the crushed stone industry.

The convention heard about postwar highway projects, particularly New York State's projects, now perhaps farther advanced than any other plans. Proponents of the American Association of State Highway Officials defended the plan of federal aid for roads under legislation now proposed. This was followed by a presentation of the so-called "Cox Plan" calling for more equitable redistribution of funds contributed by the states to the federal government.

Fred O. Earnshaw of Carbon Limestone Co., Youngstown, Ohio, was elected president of the N.C.S.A., succeeding Wm. N. Andrews of New Castle, Pa. Milo A. Nice of Hercules Powder Co., Wilmington, Del., became chairman of the Manufacturers Division, succeeding J. Harper Fulkerson of Cross Engineering Co.

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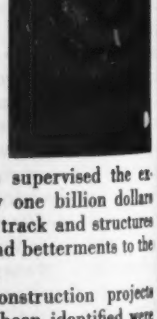
W. H. Kirkbride retires, with So. Pacific 42 yrs.

W. H. Kirkbride, 70-year-old chief engineer of the Southern Pacific Co., retired Jan. 31, following an engineering career of nearly half a century. He had been associated with the railroad for 42 years and chief engineer since April, 1932. Since 1918 he has supervised the expenditure of nearly one billion dollars for maintenance of track and structures and for additions and betterments to the railroad's facilities.



Among major construction projects with which he has been identified were the rail line around Shasta Dam, the Martinez-Benicia, Calif., railroad bridge, and the Los Angeles Union terminal. He had general supervision of nearly 9,000 miles of railroad in seven states and took a prominent part in studies involving the San Francisco-Oakland Bridge.

Vast work program in reserve, says Ickes

In the annual report of the Secretary of the Interior, transmitted to the President on Jan. 27, Mr. Ickes said that a vast work program, much of which could be launched within 30 days after victory, has been formulated and is being kept up to date. A single type of project in this program—power and irrigation construction—would keep 480,000 demobilized service men and war workers gainfully employed for three years and would open farm settlement opportunities to 165,000 families when complete.

Secretary Ickes said the Interior Department is also considering the problem of finding a place in peacetime economy for the large new industrial plants of the northwest, which grew up on the low-cost power provided by the Interior Department and which flourish now on war production, but have no interrupted work to resume when the war ends.

"We have also kept in mind the huge contribution which the United States will have to make to replenish the world's war-depleted larder," the Secretary reported. "Accordingly, the department is prepared to extend irrigation to 6,000,000 additional acres after the war and to supplement the water supply which now irrigates 9,000,000 acres inadequately. Six Interior Department bureaus have worked together, and continue to work, on a food production program that embraces extended irrigation, range conditioning for the production of more meat, various means of increasing the production of fertilizer, the further tapping of fish and wildlife resources, and much besides.

"We also continue to prepare for the day, only decades—not centuries—in the distance, when our liquid fuel reserves will be depleted to dangerously low levels. To cushion the shock of that inevitable occurrence, we furthered our experiments in extracting liquid fuels from coal and oil shales which are abundant."

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New water treaty signed between U. S. and Mexico

A treaty providing for the more efficient use of the waters of the Colorado and Tyuana rivers and the Rio Grande was signed on Feb. 3 by representatives of Mexico and the United States including Lawrence M. Lawson, U. S. Commissioner on the International Boundary Commission, a civil engineer who has had an active part in the development of the Rio Grande. This treaty changes the commission's name to the International Boundary and Water Commission, United States and Mexico.

Details of the provisions of the new treaty have not yet been made public, but the formal announcement of the signing of the treaty states that under its provisions the two governments will undertake construction of additional facilities for flood protection and the storage of water for agricultural, municipal and industrial use, including large storage and flood protection work along the Rio Grande between Fort Quitman and the Gulf of Mexico. The possibilities of water power development along the border also will be explored.

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Court aids Chicago in pollution fight

The U. S. Supreme Court, on Feb. 7, denied a motion by the state of Indiana that the court dismiss a complaint by the state of Illinois that Indiana and four of its cities are polluting the waters in Lake Michigan from which Chicago draws its supplies. The Indiana cities named are Whiting, East Chicago, Gary and Hammond, all in the so-called Calumet industrial district.

The Illinois bill of complaint, filed last November, sets forth that sewage of the four cities and the industrial waste of the district are directly and indirectly discharged into Lake Michigan, a large part of the discharge being untreated, and much inadequately treated. These wastes, the bill said, "are driven by winds and tides northward to the immediate vicinity of the water intakes of the city of Chicago," which adjoins Indiana at that state's northwest boundary.

Drainage from the Calumet district is through Calumet River, whose upper flow goes through the Indiana Harbor Ship Canal into the lake.

Indiana, in response, asked that the complaint against it be dismissed on the grounds that it could not be held responsible for disposal by the individual cities. This the court refused to do.

Now that the court has denied Indiana's motion, that state is in a position to ask that a master be appointed to conduct hearings. It could thereafter take exception to the master's hearing, whereupon the court would again act.

LIMA — The Peruvian Government has approved plans for one of the largest irrigation projects in Latin America, to cost $15,000,000, on the western slope of the Andes north of Chimbote Bay. The project will irrigate 250,000 acres of partially irrigated and arid land and will include a 100,000 kilowatt hydro-electric project on the Santa River; work on the latter is now under way.

Paul Hansen, consultant, dies at Chicago, Feb. 6

Paul Hansen, 64, of Greeley and Hansen, Chicago, prominent consultant on waterworks and sanitary engineering, died Feb. 6.

A graduate of the Massachusetts Institute of Technology in 1905, Hansen

Paul Hansen

spent his early professional years in sanitary engineering throughout the midwest. During the first world war he served as captain in charge of water supply for a sector in France. In 1920 he joined the firm of Greeley and Hansen.

Recently, Mr. Hansen had been a member of a technical committee of the War Manpower Commission.

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Monadnock owners win Chicago subway suit

Owners of the Monadnock building at Jackson and Dearborn Streets, Chicago, were awarded $104,278 by a jury Feb. 4 in a suit against the city for reimbursement for money spent to prevent potential damage because of the construction of the Dearborn St. subway. This is the first major award against the city in a long list of suits filed for alleged property damage by construction of the subway system. The owners sued for $225,000, contending they had spent that amount in underpinning part of the original floating foundations to hardpan (*ENR*, Sept. 26, 1943, p. 422). The city charged that the owners had encroached 12 ft. upon the public street in erecting the building and that much of the money was spent in making corrections to bring the building within the proper limits.

Accelerated road plans considered at Chicago

(*Continued from page* 54)

and local groups in planning not only the improvement of local roads to conform with agricultural plans for the best use of the land, but also to discover and agree upon the roads which should not be improved and those that should be abandoned because as a continued public responsibility they impose an impossible financial burden and promote the continued use of submarginal land. He pointed out that studies in several selected counties throughout the country have resulted in a substantial reduction in their rural roads to be maintained by public funds.

As of December 1, 1943, the national federal aid program was in shape to advertise about $170,000,000 worth of work in 30 days, an additional $190,000,000 in the following 60 days, and an additional $375,000,000 in the following three months, or a total of $735,000,000 within six months.

Federal postwar planning

Interest of the federal Bureau of the Budget in federal postwar construction was outlined by Harold D. Smith, director of the bureau. The President has directed all federal agencies to prepare and keep up to date realistic and carefully planned long-range programs and submit such programs to the budget bureau. Mr. Smith emphasized, however, that in regard to public-works planning the bureau has not and never should have, the responsibility for the original planning job. Federal public-works planning must be done in the first instance by those agencies that are responsible under Congressional authorization for undertaking works and omprovement projects.

Mr. Smith called upon state and local governments to do their share in planning, financing and building the postwar program, especially in view of the greatly increased financial position of these public agencies. It is true, he pointed out, that while the payment of debt and accumulation of liquid assets by state and local governments has largely been merely an offset to under maintenance of existing properties and deferment of new construction, the accumulated reserves of liquid assets and borrowing power available to finance useful public works and services place the state and local governments in a fine position to go ahead with its projects.

Mr. Smith also warned that while it is possible that postwar conditions may require a large public-works expenditure to ease the transition to a peacetime basis, these expenditures alone cannot be relied upon to carry us through a difficult readjustment. Once that readjustment is made, however, and a balance again is achieved in our economic system, we should look forward to a continuing large volume of construction activities if we are to have the high employment we hope to achieve. Public works will comprise a part of that volume, the proportion being determined in the first instance by our needs for the public services such work will provide. It is within this framework of basic policy that the Bureau of the Budget will carry out its function of coordinating public-works planning and programming in the federal government, and, he concluded, this is also the framework within which state and local governments should fit their programs for public works.

Surplus war equipment

Discussion of the controversial question regarding the disposal of government-owned surplus equipment after the war, both in this country and abroad, was presented in panel form by top ranking officials of the government, the Army, state highway departments, equipment manufacturers and distributors. This problem is held to be of extremely vital importance to all roadbuilding agencies. Unless a proper solution is secured the economic structure of highway construction as well as that of allied industries will be in jeopardy.

Principal aspects of this surplus equipment situation as it affects highway construction are: (1) Should such equipment be given to the states and their subdivisions, or should it be sold to them at a reasonable charge? (2) Should it be sold to speculators to dispost of as they see fit? (3) Should the equipment be routed back into public and private construction through equipment manufacturers and recognized dealers with some regulation of prices? (4) If this equipment is either given or sold to the states and their subdivisions, should it be distributed indiscriminately or should these agencies be required to show definite need for it? (5) Should any equipment be brought back from foreign countries for disposal here?

Each public highway official has the responsibility of operating his department to accomplish the maximum amount of work with the least cost, said Hal G. Sours, Ohio Director of Highways, and his first impulse might be to secure such surplus equipment with no outlay of cash or at a reduced cost, if possible. On the other hand, indiscriminate disposal of equipment might contribute to a serious disruption of our peacetime economy. With this in mind, Mr. Sours strongly advocated strict control over the disposal.

No indiscriminate disposal

First of all, said Mr. Sours, this equipment should not be disposed of indiscriminately, whether it is given or sold to public agencies. If given, the public agency should be made to show a definite need for each item. If sold, there would be less chance of states trying to get equipment which is not actually needed. Too much machinery of certain types in the hands of a public agency creates a temptation to enter the construction field in competition with private industry, he warned, and force account work on construction should be held to the minimum required for the efficient operation of any department.

As a further example of the highway engineers' attitude towards disposal of surplus equipment, Mr. Sours reported that at the recent meeting of the Mississippi Valley Conference of State Highway Departments, a resolution was adopted advocating: (1) all construction equipment overseas at the cessation of hostilities should be left there, and (2) any surplus government-owned equipment in this country at that time should be returned to the original manufacturers for disposal through his normal trade channels.

Distributors' policies

Distribution of surplus government-owned war equipment can be accomplished most effectively through the 700 recognized equipment distributors throughout this country and Canada, said G. W. Van Keppel, president of the Associated Equipment Distributors. They know where the buyer is, what type of equipment he wants and when he wants it. Methods of the disposal of this equipment advocated at the recent meeting of the Associated Equipment Distributors (*ENR* Jan. 27, p.86), said Mr. Van Keppel, include, (1) disposition of such property through established trade channels, (2) acquisition of large quantities for speculative purposes should not be permitted, (3) sale prices for any particular class of equipment should be uniform, (4) the equipment should be sold or leased at prices which enable the government to secure a fair return, (5) sale or lease of such property should be at such a rate as to not unduly disrupt trade and commerce, and (6) the welfare of small business enterprises should be considered whenever possible.

(*Continued on page* 60)

WASHINGTON HIGHLIGHTS

The price of laminated wood structural members, such as rafters, joists, arches and wood trusses used in building construction, has been increased in compliance with an Office of Price Administration regulation. The increase is blamed on higher prices of materials going into such products and also to higher wage rates. Previously, ceiling prices charged both by manufacturers and dealers were the highest prices which individual sellers charged during March, 1942. Now, manufacturers are permitted to calculate prices by using current materials and labor costs plus overhead and profit realized during March, 1942. Dealers are permitted to add to their March, 1942 prices the actual increase in costs at the manufacturer's level.

The War Production Board has simplified somewhat the method by which purchasers of Southern yellow pine lumber and certain species of hardwood can file applications. Previously, it was necessary to designate the producers from whom the lumber was to be bought. Now purchasers are required only to indicate on their applications for authorization the wholesalers from whom they will purchase.

In order to increase the production of lumber and other wood products, the War Production Board, War Food Administrator, and War Manpower Commission have combined forces to enlist farmers in the work of such production. It is estimated that farm woods annually produce the timber for about one-third of all forest products.

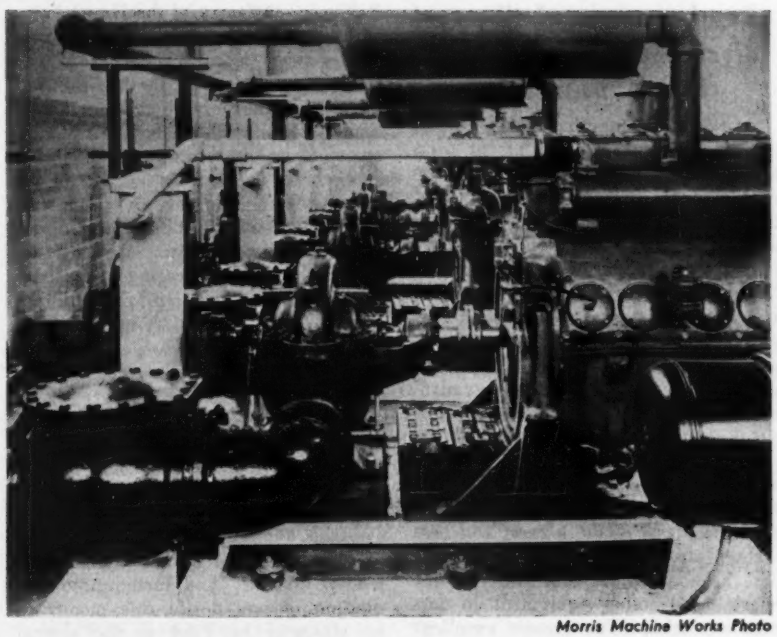
The Automotive Division of the War Production Board has announced that since the truck rationing program went into effect in March, 1942, a total of 192,433 vehicles of all types has been released, of which 21,725 were heavy trucks, 42,625 were light weight, and 107,806 were medium. There were also 17,026 trailers, and 2,128 third-axle attachments, and 123 miscellaneous vehicles. Figures are not available as to how many of these went to construction contractors.

The Office of Price Administration has permitted the addition of actual freight charges to 95 percent of the maximum f.o.b. plant price for sales of vitrified clay sewer pipe and allied products made to government agencies outside normal market areas of a plant.

Because the war has necessitated greatly increased use of these products, production in many areas has not been sufficient to meet needs in those areas. Consequently shipments have been made from producers in surplus areas to the areas where shortages exist.

The War Production Board has relaxed its regulation requiring owners of idle used resistance welding equipment to register such equipment with the board, unless specifically requested by WPB. Resistance welding equipment under the order is defined as "equipment manufactured for use in the operation of joining metals by the resistance welding process and includes resistance welding machines, resistance welding controls, and resistance welding electrodes."

To make an appraisal of forest resources, the American Forestry Association has announced that it will undertake to make a survey under the direction of John B. Woods, Portland, Ore., formerly forester for the Lumber Code Authority under the National Recovery Industrial Administration. He will be assisted by an advisory council which will include, among others, William B. Greeley, Seattle, Wash., former chief forester of the United States, and now secretary-manager of the West Coast Lumbermen's Association.



Morris Machine Works Photo

Pumping station completed at New London

An ample water supply at low pumping cost is expected to be provided at New London, Conn., by a new pumping station recently placed in operation. The main units consist of the four double-suction, centrifugal pumps pictured above. These units obtain water from the city-owned Lake Konomoc, and discharge through a 24-in. main into three concrete standpipes, each of 1½ million gal. capacity.

The piping layout permits the three standpipes to be bypassed for emergency fire pumping. Operating thus, under reduced heads, each unit is capable of delivering up to 2,450 gpm. Normally each pump operates at 1,140 rpm. and delivers, 1,750 gpm. against a 125-ft. total dynamic head.

Usually gears are considered necessary when diesel engines are used to drive single-stage centrifugal pumps at high or moderate heads. However, the pumps illustrated have large-diameter impellers of a type that eliminate the need for intermediate gears. Maintenance is expected to be reduced.

Kenneth H. Holmes, New London city engineer, was in charge of the selection of the equipment. The general contractor was N. Benvenuti & Sons.

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Construction manpower declines 100,000

In a forecast of manpower needs for the first half of 1944, Paul V. McNutt, chairman of the War Manpower Commission, said that a decline of 100,000 is expected in construction employment, reducing the industry's employment to 700,000. This low level, he said, reflects continued shortages of materials available for non-war building activity.

Road equipment disposal discussed by A.R.B.A.

(*Continued from page* 58)

At the end of another six months of shipping construction equipment overseas, what then remains in this country will be inferior in grade and incapable of properly performing postwar construction. These startling statements were made by Lt. Col. E. R. Needles, U. S. Corps of Engineers. Our big job right now is to condition certain types of this construction equipment needed overseas, he declared, and no one in the Army has, as yet, advocated bringing it back after the war. At the present time, the demand for certain types of construction equipment overseas is three times that of the available supply, he said. Col. Needles predicted that one of the biggest and best markets the equipment manufacturers will have after the war will be for heavy construction equipment in foreign countries. The present excellent performance being given by such equipment will be the chief factor in creating this world-wide market, he said.

Normal methods favored

A vigorous appeal to let the equipment manufacturers distribute and resell any surplus government-owned construction equipment in their own way and without governmental supervision was made by E. R. Galvin, president of the manufacturers division of the A.R.B.A. If the disposal of such equipment is left to inexperienced agencies, they will not know how best to sell it and they are apt to do so in such a manner as to ruin the economy of business, he said.

In answer to the question: "Can used guaranteed equipment be sold for more than 85 percent of its list price?", A. R. Guider, chief, requisition division, Foreign Economic Administration, asserted that it could in only one instance. According to OPA regulation 136, crawler-type equipment could be sold for overseas service at 90 percent of its list price.

The acquisition of surplus equipment for speculative purposes does not occur except when the sale price is exceptionally low, contended C. E. Mack of the procurement division, U. S. Treasury Department. This evil procedure is being controlled through accepting sealed bids only, and in addition the procurement division will not accept bids lower than the estimated worth of the equipment as ascertained by experts in the various fields, he said.

Although several legislative committees have been appointed to sutdy postwar problems their progress to date has been none too good, said J. W. Robinson, chairman of the House Committee on Roads. As far as constructive postwar planning is concerned, the roads committees of the House and Senate are the only committees which have before them legislation involving an effective postwar program. That another WPA must be avoided at all hazards is the consensus of Congress, said Congressman Robinson, and representatives from each state should be on hand Feb. 29 when hearings are scheduled to start on the federal roadbuilding legislative bill, HR 2426, now pending in Congress.

County road plans

Direct federal aid for county road construction is not being advocated by the county highway division of the A.R.B.A. The division is asking that $400 million of federal funds be made available annually for the improvement of rural roads not part of the state or federal system. And furthermore, the division officers desire this money to be allocated by PRA to the several states by the same formula as are other federal highway funds, with the states apportioning it to their several counties in the ratio of one-third on population, one-third on area and one-third on rural-roads mileage exclusive of the state and federal roads. Under this proposed scheme the state highway departments would act as agents for PRA in establishing design standards.

The counties will prepare detailed plans, specifications, estimates and contracts for submission to their respective state highway departments prior to receiving bids and awarding construction contracts. That construction of rural roads by counties will provide widespread distribution of employment, that such work should be performed by the contract system on projects costing more than $5,000, was the consensus of the county roadbuilders at the meeting.

Post road improvement

An overall picture of the vast network of rural roads in this country was given by Thomas G. Walters, president of the National Rural Letter Carriers' Association. Quoting from the recent report of the National Interregional Highway Committee, Mr. Walters warned the assembled roadbuilders that the accumulated surface-reconstruction needs on rural roads alone now total some 1,700 mi., and, if reconstruction is deferred another year, the total will approach 2,650 mi.

The rural mail carriers support the building and maintaining of all types of roads, asserted Mr. Walters, but they believe at least 25 percent of all money appropriated for such work should be allocated by law to be spent on school bus routes, farm-to-market roads, post roads and other roads not listed on federal and state highways, as well as city streets.

Federal aid to cities

In recommending provisions for legislative action granting federal aid for city street and highway improvement, the municipal division of A.R.B.A. advocated direct federal aid to those cities with a population of 10,000 or more. In the smaller cities, the major streets usually are state highway extensions and their improvement should be placed under state supervision. No definite amount of federal funds was suggested for city street improvement, but the municipal division suggested that such funds be apportioned to cities on a basis of population, area and street mileage similar to that adopted for apportioning federal aid to states. Under this proposed plan, the cities would match federal funds on a 50-50 basis, and would be required to establish their competency to administer the expenditure of federal funds.

Peace problems here now

The war is already over for certain industries, such as construction and machine tools, declared Paul G. Hoffman, chairman of the Committee for Economic Development and president of the Studebaker Corp., and these industries are already face to face with most of the problems which peace will bring. In outlining the peace problems, Mr. Hoffman said his committee estimates we must have, after reconversion, from 55,000,000 to 58,000,000 peacetime jobs, or 9 to 12 million more than in 1940. These figures are comparable with those estimated by labor and by the Brookings Institution. This increase over the last peacetime year is the figure to concentrate on, according to Mr. Hoffman, if we are to avoid either mass unemployment or mass government employment.

Measuring our task in terms of jobs, Mr. Hoffman went on to say, it is most important that our goal be stated in terms of productivity rather than jobs. Merely "jobs for all" and not the right kind of jobs will take us straight down the road of disaster. He declared the objectives of the Committee for Economic Development are not in conflict with objectives of those responsible for public works. The committee is fully conscious of the need for a postwar program of public works. That need will be greatest in the immediate postwar period, he said.

Highways alone will provide a substantial amount of public works for, the deferment in construction and maintenance of highways has created a great need in this field. Before war restric-

tions cut down the volume of traffic, Mr. Hoffman pointed out, we were vainly trying to operate a 20th century transportation system on 18th century roads and streets which alone calls for much advanced thinking.

Bartlett award to Mattimore

The George S. Bartlett Award for distinguished and outstanding contribution to highway progress was presented to H. S. Mattimore, for a quarter of a century engineer of tests and research for the Pennsylvania State Highway Department. For more than 40 years Mr. Mattimore has taken an active interest in the improvement of highway construction, and is recognized internationally as dean of testing engineers.

In presenting the award, attention was called to his ceaseless energy as evidenced by his work through research and scientific groups which include the Highway Research Board, of which he has been chairman, the American Society of Testing Materials, the American Association of State Highway Officials, and the American Society of Civil Engineers. For each of these groups he has served as chairman of special research committees. Upon leaving the Pennsylvania Highway Department a year ago Mr. Mattimore accepted a civil position with the Bureau of Yards and Docks, U. S. Navy.

Executive officers

Carl W. Brown, chief engineer, Missouri State Highway Department, was reelected president for the forthcoming year, and H. C. Whitehurst, Washington, D. C. was reelected treasurer. Vice presidents elected to succeed themselves include: Paul B. Reinhold, Pittsburgh, Pa.; Charles W. Smith, Pensacola, Fla.; and Robert A. Allen, Carson City, Nev. E. R. Galvin, Peoria, Ill., was elected vice president of the Central District. Divisional presidents, reelected for 1944 include: E. R. Galvin, Manufacturers' Division; R. B. Traver, Syracuse, N. Y., County Highway Officials Division; R. W. Gamble, Milwaukee, Wis., Municipal Division; James J. Skelly, Media, Pa., Highway Contractors' Division; and Carlos Bazan, Mexico City, Mexico, Pan-American Division.

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More money requested for access road work

Bills have been introduced in both branches of Congress increasing by $30,000,000 the amount authorized for access roads by the Defense Highway Act of 1941. The money is to supplement the exhausted sum of $150,000,000 authorized in 1941, which was augumented by $110,000,000 in 1942.

JOBS OF THE WEEK

STOREHOUSES, Yorktown, Va.

Bureau of Yards & Docks, Navy Department, Washington, D. C., awarded a contract for the construction of warehouses, at Naval Mine Depot to Virginia Engineering Co., Newport News, Va., at $1,388,3000.

DWELLINGS, Sollers Point, Md.

Tovell Construction Co., Baltimore, Md., has been awarded a contract by Baltimore Housing Authority, Baltimore, to build 400 temporary dwellings. PHA will finance. The cost is $1.074,000. Albert D. Cassell, Washington, D. C., is the architect.

BARRACKS and FACILITIES, Treasure Island, Calif.

George A. Fuller Co., San Francisco, Calif., has been awarded a contract for the construction of additional barracks and facilities by Bureau of Yards & Docks, Navy Department, Washington, D. C., at $734,500.

AIRPORT, Urbana, Ill.

University of Illinois, Urbana, awarded a contract to grade, drain and pave a 780-acre airport to Johnson Greene Co., Ann Arbor, Mich., and to Cooke Contracting Co., Detroit, Mich., at $1,334,177. Civil Aeronautics Authority will supervise.

AIRPORT, Goose Bay, Labrador

Department of Transport, Ottawa, Ont., has awarded a contract for connecting taxi strips, clearing, stumping, erection of gasoline tanks, buildings and electric services to McNamara Construction Co., Ltd., Toronto, Ont. The estimated cost is $1,750,000.

MUNICIPAL AIRPORT, Alturas, Calif.

Larsen Brothers and Harms Brothers, Sacramento, were the lowest bidders on schedules 1 and 2 for runway at Alturas Municipal Airport at $851,391. Civil Aeronautics Administration, Santa Monica, opened the bids.

DWELLINGS, Montebello, Calif.

Beverly Homes, Los Angeles, Calif., will construct 105 frame and stucco dwellings by their own forces. The estimated cost is $500,000.

ATOMIZED ALUMINUM PLANT, Glassmere, Pa.

Day & Zimmerman, Inc., Philadelphia, Pa., has been awarded a contract for atomized aluminum plant for the Aluminum Co. of America, Pittsburgh, for the Navy Department. The estimated cost is $800,000.

HOSPITAL BUILDING, Cincinnati, O.

Veterans Administration Facility, Washington, D. C., awarded a contract for additional buildings and utilities at Veterans' Hospital to Penker Associates, Inc., Cincinnati, Ohio, at $1,129,000.

RESIDENTIAL DEVELOPMENT, Philadelphia, Pa.

Warner West Corp., Drexel Park Gardens, will construct by its own forces a residential development at Drexel Park Gardens, Delaware County, to cost $500,000.

Note—Additional bidding and contract news on many projects large and small appear in the Construction News section beginning on page 63.

Pentagon Building's cost to be investigated

On Feb. 6 members of three congressional committees demanded an investigation by Congress as to why the War Department's Pentagon Building cost almost $75,000,000 instead of the $35,000,000 originally appropriated for the work.

The committees, some of whose members desire to look into this matter, are Ways and Means, Military Affairs, and Appropriations.

Big war housing program completed in Virginia

A total of 55,475 war housing units were programmed for Virginia during 1943, 47,899 of which were completed during the year, Robert K. Creighton, regional representative of the National Housing Agency at Atlanta, announced Jan. 21.

Mr. Creighton said the remaining 7,576 units are either under construction or scheduled to begin at an early date.

OBITUARY

Egbert Jessup Moore, 66, vice president of the Turner Construction Co., of New York and an engineer noted for his work in the development of reinforced concrete design in building construction died at Yonkers, N. Y., Feb. 1. Among the large structures Mr. Moore planned were the Bush Terminal Warehouses and both the Army and Navy first World War bases in Brooklyn.

Gus Lawffer of Amboy, Wash., general superintendent of the United Contracting Co., of Portland, Ore., died at Portland Jan. 28. He had been associated with the firm for more than 30 years.

Edward J. Prendergast, civil engineer with the Bureau of Reclamation, died Jan. 21 in Friant, Calif., site of the Friant Dam, where he was employed.

Frank W. Hanna, 76, former chief engineer and general manager of the East Bay utilities district, Oakland, Calif., died Jan. 26 in Webster City, Iowa. Mr. Hanna once headed the Canadian Land and Improvement Co. in Medicine Hat, Alta. In 1924, he went to Oakland as a hydraulic engineer for the utilities district and, in 1939, he was made chief engineer. Prior to moving to Oakland, Mr. Hanna was connected with the U. S. Geological Survey and the U. S. Reclamation Service. Later, he became one of the designers of Pardee Dam on the Mokelumne River.

Roy S. MacElwee, 60, internationally known authority on port and harbor development, died at Arlington, Va., Feb. 6. He was serving as consulting engineer to the transportation section of the War Department. He was author of "Port and Terminal Facilities," "Port Development," and other books relating to foreign trade.

Waddy Butler Wood, 74, died near Warrenton, Va., Jan. 25. He had been a member of the architectural firm of Wood, Donn & Deming, in Washington, D. C., for 16 years. During that period, he designed the new Interior Department Building, the Brookings Institution buildings, the Stock Exchange Building, the Chinese Embassy, and the Geophysical and Terrestrial Magnetism Laboratories for the Carnegie Institute.

News of the Week
Continued on p. 103

CONTRACTS AND CAPITAL

CIVIL ENGINEERING construction volume in continental U. S. totals $23,151,000 for the week. This volume, not including construction by military engineers abroad, American contracts outside the country, and shipbuilding, is 35 percent lower than in the preceding week, and 67 percent lower than the total for the corresponding 1943 week.

Private construction is 78 percent below a week ago, and 23 percent under a year ago. Public construction tops last week by 17 percent, but is 71 percent below the week in 1943.

The current week's construction brings 1944 volume to $215,192,000* for the six weeks of the year, a decrease of 43 percent from the $379,561,000 reported for the period in 1943. Private construction, $47,979,000, is 52 percent higher than in 1943, but public construction, $167,213,000,* is down 52 percent as a result of the 23 percent decline in state and municipal work, and the 53 percent drop in federal volume.

In the classified construction groups, gains over last week are in sewerage, public buildings, and earthwork and drainage. Increases over the 1943 week are in industrial and commercial buildings, and streets and roads.

New capital for construction purposes for the week totals $3,486,000, and is made up entirely of state and municipal bond sales. The week's new financing brings 1944 volume to $153,074,000, a total that compares with $5,447,000 for the opening six weeks of 1943.

* *Revised.*

CONTRACTS

Continental U. S. Only
(Thousand of Dollars)

	Week Ending Feb. 11 1943	Feb. 3 1944	Feb. 10 1944
Federal	$64,182	$14,357	$16,939
State & Municipal	1,225	1,786	1,969
Total public.	$65,407	$16,143	$18,908
Total private	5,532	19,380	4,243
TOTAL	$70,939	$35,523	$23,151

Cumulative
1944..... (6 weeks) $215,192*
1943..... (6 weeks) $379,561

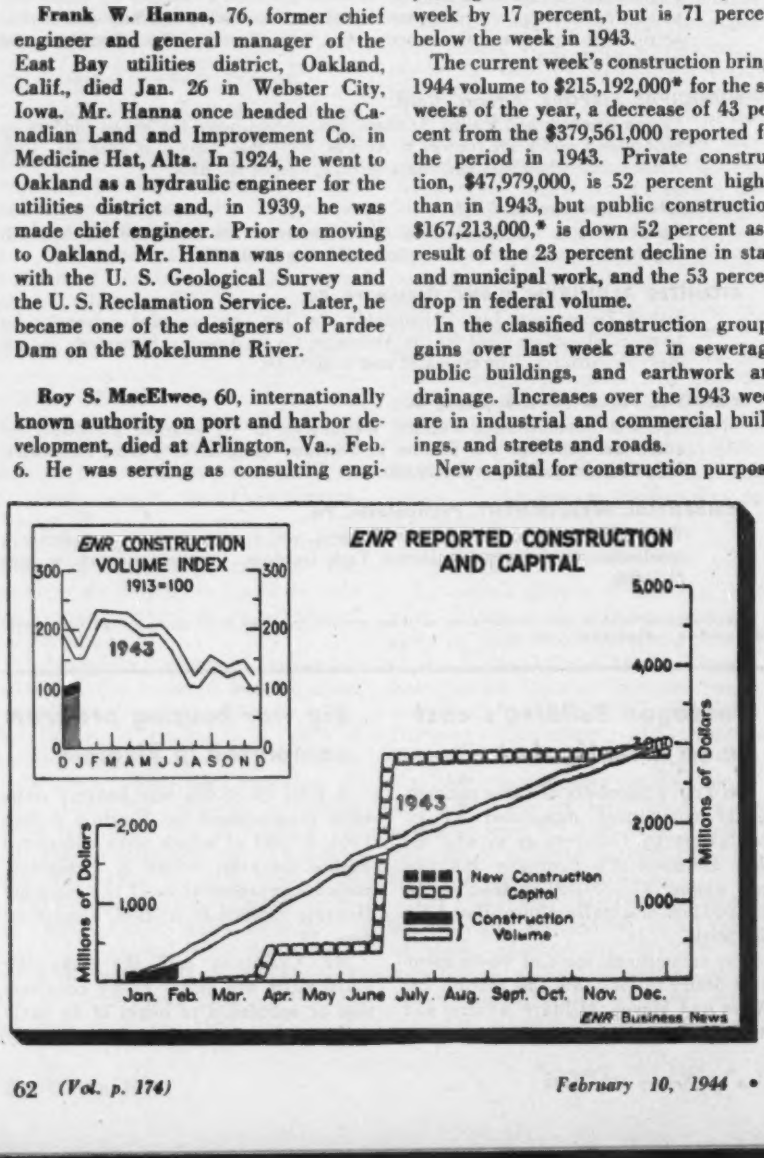
Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.
*Revised.

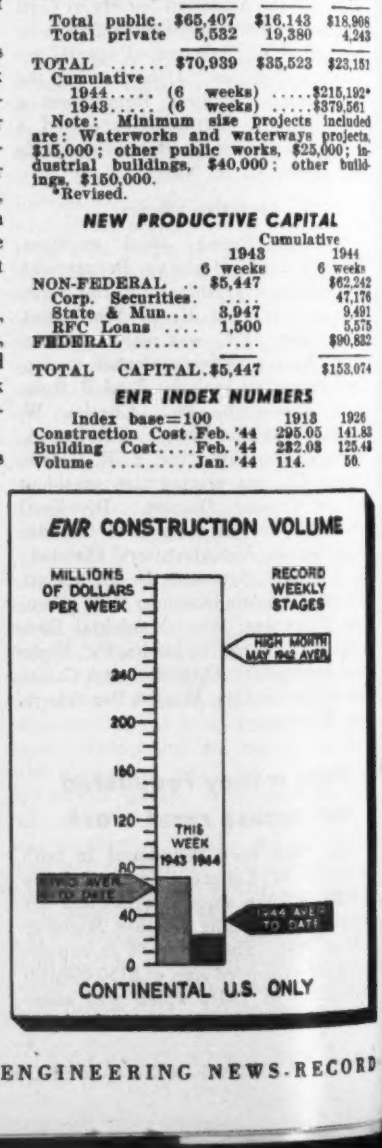
NEW PRODUCTIVE CAPITAL

	1943 6 weeks	Cumulative 1944 6 weeks
NON-FEDERAL	$5,447	$62,242
Corp. Securities	....	47,176
State & Mun.	3,947	9,491
RFC Loans	1,500	5,575
FEDERAL	....	$90,832
TOTAL CAPITAL	$5,447	$153,074

ENR INDEX NUMBERS

		1913	1926
Index base=100			
Construction Cost	Feb. '44	295.05	141.83
Building Cost	Feb. '44	282.03	125.43
Volume	Jan. '44	114.	50.


ENR CONSTRUCTION VOLUME INDEX
1913=100
1943
J F M A M J J A S O N D
ENR REPORTED CONSTRUCTION AND CAPITAL
1943
New Construction Capital
Construction Volume
Millions of Dollars
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
ENR Business News



Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Flat Slab Roof Costs

Sir: In connection with the article "Flat Slab Concrete Roof Found Economical" (*ENR* Oct. 21, 1943, p. 637), certain figures are given and statements made which are misleading.

The author's cost comparison is evidently based on the estimate of only one contractor apparently favoring, for reasons of his own, a flat roof design and, therefore, being less interested in the barrel roof on which, besides him, all other bidding contractors received full information.

The author makes a unit cost comparison between three types of warehouses in dollars per square foot of plan area. His tabulation, based on three of the many bids received, gives a unit cost for the barrel arch design of $2.126, and for the flat slab design of $2.134, conveying the impression that the barrel arch design was only a fraction of 1 percent cheaper. Possibly the author was not aware that four other bids were received for the barrel arch design that were lower in cost than the flat slab design. The low bid on the barrel arch design (Z-D thin shell concrete construction) represents a unit cost of $1.866, or about 13 percent less than the cost of the flat slab design (a total differential of $561,580 for the project).

The flat-slab design and the barrel-shell design have certain bomb resistant advantages in common—monolithic framing, small glazed areas, no bearing walls, etc. The ability of continuous structures to localize bomb damage has been demonstrated. The dome-like roof shells of the barrel arch design have advantages, however, not found in the flat slab design. Shells offer small resistance to bomb perforation and thus assure localization of initial damage. The space action and the uniform distribution of reinforcing steel provide strong resistance against explosions (both positive and negative pressures). This resistance cannot be expected from the flat slab which acts in one plane, and is designed to withstand only wind and gravity loads. The carrying power of concrete shell structures has been proven in action although only a meager amount of data has been released. The reader is referred to the article, "Thin Concrete Roof Withstands Fire Test" (*ENR*, June 3, 1943) reporting the ability of barrel shell domes to withstand great pressures.

ANTON TEDESKO
Managing Engineer,
Washington Office
Roberts and Schaefer Co.

Engineers and Public Health

Sir: I read with a great deal of interest your editorial "Engineers and Public Health" p. 587, of the Oct. 21, 1943, issue. Having had six and one half years experience in the mapping of field programs for some of Florida's west coast counties I can agree with you that the premise is largely that of the engineer.

It has been grevious to discuss mosquito control with politicians or people who have had executive authority thrust upon them. It seems these people cannot grasp the idea that an engineer is as important as a trained health officer. This officer is usually a physician who is versed in the ills of the human body and knows, or should know, the parasites of malaria, but he is usually ignorant of the mechanics of field engineering and its counterpart, the drafting board.

The engineer can make a topographic survey and corellate each part wherein every unit has each of its segments in coordination and a gradient of which the hydraulic grade will permit functioning as planned, so that the most remote part of the unit will carry off the surface water—not sub-surface water—and permit the normal activities of the surface-feeding minnow in destroying the larvae of mosquitos.

Many people regard the mosquito as a nuisance to be tolerated. The purchase of patent remedies is a panacea. But they regard the languid feeling, the irritating humor or the grouchy attitude as one of man's annual necessities, even if part is spent in bed, or he lays around, disinterested and inefficient. Most people will not admit that their condition is brought about largely because of the lack of knowledge regarding the mosquito.

So it is important that the health officer be a physician, but it is equally important that the field officer, if we may call him that, be an engineer. The two make an ideal team and together they can rid a community of the mosquito.

ERNEST A. TAYLOR,
5212 Jules Verne Court,
Tampa, Fla.

Polio and Mosquitoes

Sir: May I make a late comment on a subject that was discussed in the Oct. 28, 1943, issue of *Engineering News-Record*, in the article entitled "Survey Shows Little Change in Postwar Sewage Equipment"? This article showed some interest in the possibility of sewage containing the poliomyelitis virus.

I know nothing of polio, except that it is a dreadful disease, but while employed on a U. S. Engineer Department project at Jacksonville, Fla., in February, 1943, I talked with a major of the Medical Corps, who expressed an opinion that the *Aedes egypti* mosquito (which transmits both yellow and dengue fevers) might also transmit the poliomyelitis virus. The major, whose name I cannot recall, thought this might be possible since, by preference, this mosquito can be found in the effluent from either septic tanks or other community sewage disposal facilities.

The idea, as I recall the short discussion, seemed to be that the wriggletail, or larva, thrived in this polluted water, and upon pupation and subsequently emerging as a full-grown adult insect, it lost none of its body components; therefore, if the virus of polio was in the mosquito's blood stream, it was possible to transmit these parasites into a human blood stream in exactly the same manner as the *Anopheles* mosquito transmits malaria parasites.

I pass this information on for whatever value it may have to stimulate further discussion.

ERNEST A. TAYLOR,
Tampa, Fla.

EDITORIALS

VOLUME 132 NUMBER 6

February 10, 1944

Engineering News-Record is a consolidation of Engineering News and Engineering Record, effected in 1917. The Contractor was consolidated with Engineering News Record in 1918. Engineering News was founded in 1874 as The Engineer and Surveyor, which title subsequently became The Engineer, Architect and Surveyor, Engineering News and American Railway Journal and finally Engineering News. Engineering Record was established in 1877 as The Plumber and Sanitary Engineer. Subsequently it became The Sanitary Engineer, Engineering and Building Record, and finally, Engineering Record. All rights to the above titles are reserved.

Middle East Construction Coming

SOME OF THE RESULTS of the Middle East oil negotiations that have been shrouded in the veil of high governmental secrecy for some months past were announced last week by Secretary Ickes in his position as president of the government-owned Petroleum Reserves Corp. As predicted in these columns (*ENR* Dec. 2, 1943, p. 801), it adds up to new opportunities and new jobs for American engineers and construction men. Significantly, too, the vast projects planned are to be carried out through the cooperative efforts of government and private business. The results will bear watching as possibly foreshadowing a pattern for other postwar activities abroad. Apparently, in this instance, the private oil companies, who hold the development concessions from the foreign governments, retained for themselves the rights to carry out production and refining, while contracting with PRC to finance and build an 800-mile pipeline from the Persian Gulf to the Mediterranean Sea, whose cost the companies will amortize over a 25-year period. The fact that the pipeline alone is estimated to cost around 150 million dollars gives some idea of the scope of the operations that are soon to be the responsibility of American engineers and construction men working 10,000 miles from home.

On Specifying Aggregates

MANY ENGINEERS will be interested in the series of tests made in New York City and reported on p. 205, wherein gravel and stone aggregates are compared with respect to their concrete-making properties. The tests were not intended to provide answers to all questions, but they do confirm what engineers have always believed, namely that good concrete can be made from widely differing coarse aggregates. The tests strengthen the claims of those who favor specifying for the end product rather than detailing in specifications just how that product is to be made. Gravel no larger than peas is used in Kansas to make strong and durable pavements and structural concrete. Coral rock in the South Pacific has been used for many hard-to-take fortifications. In New York, crushed dolomite limestone has been most widely used for aggregates, but these tests indicate that the local quartz gravel is also satisfactory. There are many combinations of materials that will make good concrete, and specifications should take advantage of that fact to the greatest extent that is possible.

It's An Ill Wind . . .

THE OLD SAYING that it's an ill wind that blows no one good is brought to mind by two statements in Wesley W. Polk's account of current highway operations in Illinois in the January 27 issue of this journal, p. 131. Mr. Polk notes two worthwhile effects of war activities in his state: first, a broadening of the knowledge of men on his staff with respect to the varied activities of the highway department, and, second, closer cooperation between contractors working on highway projects. The contractors, for example, in an effort to get badly needed highways built in the shortest possible time, traded men and equipment back and forth continuously. And broadening of engineering experience resulted from putting designers out in the field to alleviate the manpower shortage in the maintenance forces. Both activities can have postwar benefits, contractor cooperation being useful in sustaining the contract system of construction, and knowledge of maintenance problems on the part of designers producing better postwar plans. Such dividends offset some of war's destruction.

Vindication of Vision

NO MAN WHO HAS LABORED for the achievement of a goal has witnessed greater appreciation of his efforts than that demonstrated last week at a meeting of Texas sanitation engineers and works operators. Hardly had Victor M. Ehlers, state sanitary engineer, outlined his postwar vision for the establishment of a Sanitary Foundation—an enterprise devoted to the improvement of sanitation training and services in the Lone Star state (see story p. 167)—than people arose and publicly pledged funds in the form of War Bonds to initiate the project. And most of those who made the pledges were waterworks and sewage disposal plant operators from small towns whose subscription represents a major personal sacrifice. This spontaneous action revealed more than approval of a sound

lea; it was a glowing tribute to "Vic" Ehlers hose years of unselfish crusading for better com-unity sanitation has enlisted the support of every-ne with whom he comes in contact, and has pro-ided Texas with a record of achievement that is econd to none in the nation. Few men in the field f public health promotion have ever received or eserved a greater measure of approbation than hat accorded to Mr. Ehlers.

The Field Man's Point of View

NOW THAT THE RUSH of war construction by civil-ans is over, contractors' executive and engineering orces are looking for new tasks to absorb their nergies and abilities. And because the period mmediately ahead will be characterized by design-ng and planning activity rather than construction, hese tasks may not be readily available. It is ot so much that these men may be unemployed, erious as that is, but that their talents may lie nused. That would be a calamity when there is o much to be done.

In large degree this is a problem for the design executives themselves to solve. Some of them ealize the value of the field man's point of view n the design office, and may be expected to utilize whenever possible. But there are others who ay be so steeped in the practice of using one lass of talent exclusively for design and another olely for construction that they may overlook the resent opportunity.

Contractors and engineers who have worked ogether in the past have found it mutually bene-cial. One recalls that the great buildings of Rock-feller Center in New York were the product of ngineers, architects and contracting organizations oined in a common planning and designing unit rom the very inception of the project. War jobs, hich had to be started before the plans were com-lete, also required close association of the design nd field forces. Both in the drafting room and the pecification writing office construction engineers nd administrators can be of invaluable aid.

The purpose of postwar planning is to have esigns ready that can be put under construction mmediately when the war is over. They can go head faster if the construction bugs are ironed ut of them while in the plan stage rather than after onstruction is underway. Perhaps postwar plan-ners have not overlooked the opportunity that is now theirs to augment their design organizations with men with field experience. But if they have, now is the time to examine the possibilities.

Recognition Richly Deserved

THE ANNOUNCEMENT that Ben Moreell is one of three Navy bureau chiefs nominated by the President for promotion from the rank of rear admiral to temporary vice admiral will be received with unanimous acclaim and satisfaction by civil engineers and construction men who have long recognized what great honors the achievements of this rugged and friendly wartime chief of the Bureau of Yards and Docks have brought to their profession. Moreover, the consequences of these achievements have had such a direct effect on our progress in the war to date that the country at large owes him both honor and praise.

It will be recalled that literally single-handed, and with clairvoyant foresight of Japanese intentions, Admiral Moreell obtained a large peacetime appropriation to modernize Pearl Harbor with drydocks and repair facilities. Had this not been done, we would hardly now be recovering from our defeat, much less mounting a great offensive in the Pacific. Later, his building of the Midway airbase far faster than even wishful-thinking planners thought possible, probably saved Pearl Harbor a second time. To Admiral Moreell also goes credit for the origin and training of the Seabees, whose indispensability is now so universally recognized.

A structural designer of outstanding ability; an administrator whose work has time and again been praised by Congressional committees to whom his bluff but friendly manner and frank speech have great appeal; a bureau chief who has driven himself from dawn until long after dark every day since before Pearl Harbor, Admiral Moreell is loved and respected by his subordinates and cherished by his superiors. It is probable that even the sea-going naval officers who believe that bureau chiefs in general should not be accorded vice admiral rank would welcome that distinction for Ben Moreell personally. One of the highest of these officers has said that no honor that the nation can bestow is too great to be given to him. With that opinion every reader of this journal can agree.

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Moving a Big Boiler Without Dismantling

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***Contents in Brief**—Scientific methods of load determination developed by underpinning experts were adapted to moving and raising a 750-ton high-pressure boiler at the Brooklyn Navy Yard. The object was to maintain a normal load on each support of the boiler during moving and thus prevent racking so that brick lining would not be cracked nor the tubes sprung. Moving the boiler as a unit instead of dismantling saved four months time and $75,000.*

CHANGES AT THE NAVY YARD at Brooklyn, N. Y., required enlargement of the power generating facilities and supplementing of the new units by moving an existing Riley high-pressure boiler to a different location. The boiler moved has a base area of 25.5 ft. by 33.7 ft., a height of 52.7 ft., and a weight of 750 tons, much of it concentrated high above the foundation. Movement of 78 ft. horizontally, but diagonal to the axis of the boiler, and about 11 ft. vertically was required to put the unit in the proper position in the new plant.

Fig. 1. A 750-ton boiler at the Brooklyn Navy Yard was moved 78 ft. diagonally and raised 11 ft. without cracking a brick nor springing a water-tube.

Previous practice in relocating such a boiler has been to dismantle it as carefully as possible and reassemble it in the new location. In addition to the cost and time required for such demolition and re-erection, this procedure would require a minimum replacement, by new material, of one-fourth of the water tubes and all of the fire brick. It would require the welding of all water tubes and replacement of many unsalvagable parts. Estimated cost of this method of moving was approximately $110,000; time required would be six to seven months if no delays were encountered in replacing parts that could be reused.

Moving of the boiler as a unit was investigated with the assistance of the boiler manufacturer and determined to be feasible with an estimated savings of four months in time and $75,000. A negotiated-lump-sum contract was awarded to Spencer, White & Prentis, Inc. and moving of the boiler was accomplished in the estimated time without removing even the fire brick, in fact without cracking them or springing the water tubes.

In its original position the boiler rested on a 30-in. thick concrete mat supported by wood piles. About 600 tons of the structure's weight of 750 tons rested on ten structural columns arranged in two rows of five columns each parallel to the longer horizontal dimension. This weight was concentrated in four heavy drums, water-wall tubes, water tubes, superheater, headers, economizer, boiler casing, the structural steel skeleton and most of the fire brick. Remainder of the weight was carried on four steel columns supported by concrete and ma-

onry walls and pipe columns that rested directly on the concrete mat. The latter load consisted of the boiler grates, stokers, the lower headers and a small part of the fire brick.

General plan for moving the boiler substantially intact was: (1) Distribute the load of the boiler so that six column concentrations carried the load usually on 14 supports; (2) lay heavy rail as track for horizontal moving; (3) place specially reinforced "runner-beams" on the rail; (4) place distributing beams parallel to the boiler columns, and weld supporting members over these to each of the now six working columns of the boiler; (5) raise the boiler 2 in. plus, so that 2-in. diameter shafting could be inserted as rollers between the track and the runners; (6) push the boiler to the new location by means of hydraulic jacks; (7) splice column extensions and raise the boiler to the required height, again by hydraulic jacks; and (8) complete the permanent support for the boiler.

First operation was to transfer the load of the grates, stokers and headers from the concrete wall and pipe columns to the steel skeleton of the boiler by suitable longitudinal beams. The four main stokers and header beams of the boiler were extended by means of spliced steel beams so that their ends were brought out to the row of columns where they were supported on 12 and 15 in. I-beams welded to the inside flanges of the boiler columns.

Two columns at the rear of the boiler, supporting the economizer and carrying 19 tons each, and two stub columns under the center of the boiler, carrying 44 tons each, were raised separately in pairs, about ⅛ in., by hydraulic screw jacks. Diagonal angle hangers (6x4x⅜ in.) then were welded in place to transfer the load into the three main vertical members at each side of the boiler, as may be seen in Fig. 1. To stiffen the boiler for moving, cross braces of 6x4x⅜-in. angles designed to resist 40 tons axial load, were welded diagonally across the exterior flanges of the boiler columns.

Accurately positioned track

Horizontal movement of 78 ft. 1 in. was required but in a direction at an angle of about 45 deg. to the principal axes of the boiler. It was simpler to move the boiler in two right angle moves but this would have required additional tracks and suporting structure, therefore would have entailed greater cost. The track consisted of nine lines of double 100 lb. AREA rail, Fig. 2, placed in such a position that the loads at both the front and rear of the boiler could be carried.

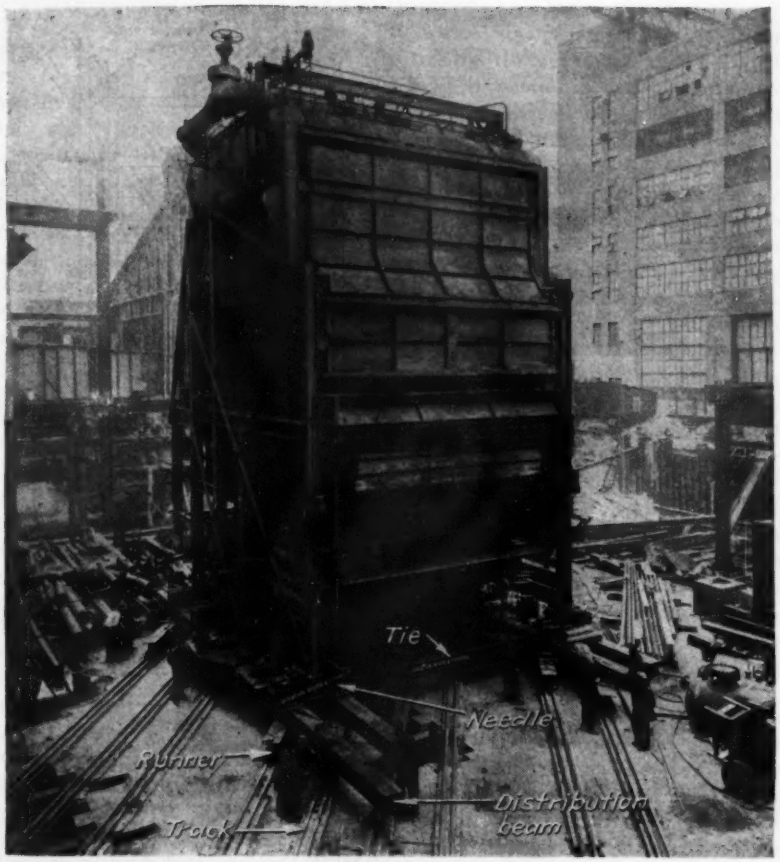


Fig. 2. Front of boiler. Pits in foreground are to accommodate 11 ft. extensions to the boiler legs. Accurate alignment and leveling of track and equitable distribution of load kept resistance to movement to only 1½ percent of the weight.

All of the rail was grouted in place with a 1:1 mixture of high-early strength cement mortar with tops of all the rails initially set to within ⅛ in. of the same elevation. After grouting a resurvey showed that the average variation from the theoretical level was 3/32 in. while the maximum variation was ⅛ in. Accurate setting of the track system contributed greatly to uniform movement and low power requirements.

Plan for moving the boiler was to use 2-in. dia., 18-in. long cold-rolled shafting on each of the nine pairs of track beneath the "runner beams." The beams were placed above and parallel to the track and in turn supported distributing beams that took the load from needle beams welded to the vertical columns.

Temporarily the runner beams were set in final position but with their top in direct contact with the top of the track. It was planned that after the temporary carriage was in place the boiler and carriage would be raised, the rollers placed between the bottom surface of the liner plates and the top of the track, thus lifting all parts of the structure uniformly and minimizing local induced loading caused by unequal raising.

Load determination and equalization

The raise necessary to permit the setting of the rollers provided an accurate final check on the individually determined load on each column. The method of determining column loads individually, as developed by the writer, is based primarily on the fact that where several columns support a load and are connected by structural framing, one of the col-

umns, if raised slightly, will increase its load by "borrowing" from surrounding columns. Conversely, if a column is permitted to settle slightly, a portion of its original load will be carried elsewhere. It is obvious, therefore, that the usual method of determining a column load by finding the force necessary to raise it always gives too large a figure, due to the ability of structural joints to develop bending.

The actual load on individual columns was determined by use of the extensometer, an instrument designed to measure small variations in length with extreme accuracy. Before raising a column, small holes were drilled in the column below the needle beams through which the raising force was to be applied, Fig. 4. Lengthening of the column between these points was measured by the extensometer when the lower portion was released from the load. From this figure, the column section and the modulus of elasticity of steel, the column load was computed accurately. The greater load necessary to raise the column also was an important figure, because it was an indication of the stiffness of the structure and because it indicated the magnitude of load variation or "roving" load to be expected from variations in the elevation of the track system.

First actual moving operation was to raise the boiler sufficiently to insert the 2-in. dia. rollers. Hydraulic screw-jacks, 4½-in. dia., actuated by hand pumps, were set on the 30-in. concrete mat, arranged concentrically at each column, thus providing 24 jacks to raise the 750-ton boiler. Four men worked at each column; two operated the hydraulic hand pumps while the other two each had immediate supervision of two hydraulic screw jacks, their principal duty being to keep the safety nut on the jacks hand-tight while the load was being raised. Fig. 6.

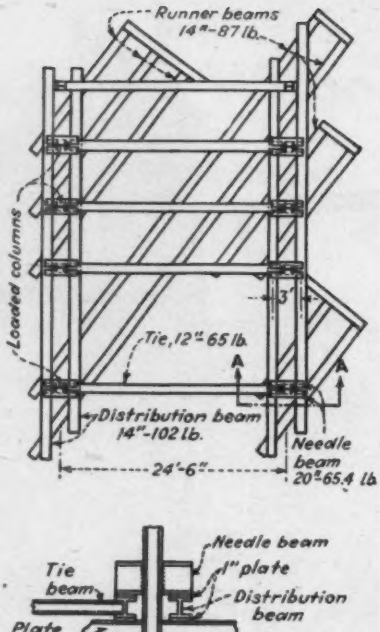


Fig. 3. Temporary frame built under boiler for transfer. Tracks parallel the distributing beams, located thus to give greatest stability with the least framing.

At a given signal, the pump-men at each of the six columns started stroking the hyd-aulic hand-pumps, kept in unison by a whistle signal for each stroke. After 30 strokes, equivalent to about ⅜-in. raise, the pumping was stopped and the raise at each column was observed by movement of measuring scales set at each of the columns.

As jacking continued stops were made at each ⅜-in. to ½-in. raise to check for differential movement. When any appreciable differential was observed it was corrected before raising was continued, maximum differential noted being 3/16 in.

When the boiler had been raised 2⅛-in. the rollers were placed between the liner plates and the track, spaced uniformly and accurately set perpendicular to the line of travel. After all of the 160 rollers were set, the structure was lowered carefully, placing the total load on the rollers, following which the jacks were removed. Raising and placing the rollers required two hours, completing preparation for moving the structure.

Horizontal tractive force for moving the boiler was applied by four plain 4½-in. dia. 10-in. stroke hydraulic-jacks set at four locations back of the boiler at the ends of the runner beams. The jacks were tack welded to cross beams at the ends of the runner beams and traveled with the moving structure. Reaction of the jacks was taken by clamps arranged to slide on the track, tilting forward under no load so that it did not bind but as pressure was applied the top rotated into a position such that its base clinched the head of the rail, preventing movement.

In preparation for moving the boiler the desired path of travel was inscribed on one rail of the track, and pointers attached fore and aft to the runner beam over this line. Thus it was possible to check the alignment of the boiler at any time. Accurate final positioning was necessary as heavy structural building columns were required within ¾ in. of the edges of the front boiler column.

During the moving operation the boiler moved off the axis line several times. Correction of travel was not made until a variation of ½ in. or more was noted and then was made by skewing rollers either at the front or rear of the boiler, depending upon which was out of position. The correction was applied gradually so that three of four extensions of the jacks were made before the correction was completed. The maximum variation reached was ⅞ in. perpendicular to

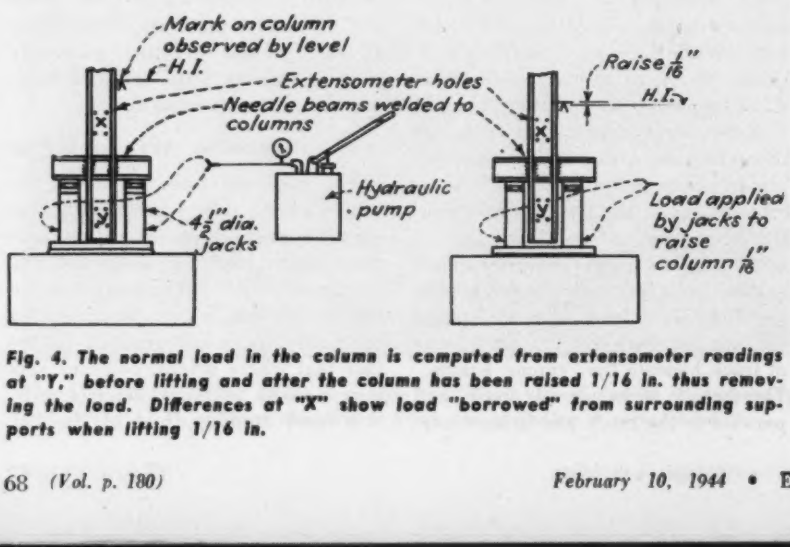


Fig. 4. The normal load in the column is computed from extensometer readings at "Y," before lifting and after the column has been raised 1/16 in. thus removing the load. Differences at "X" show load "borrowed" from surrounding supports when lifting 1/16 in.

the axis and final position was less than ¼ in. out of the theoretical.

The moving operation, including the time for moving rollers ahead, consumed 14 hours. Two hydraulic pumps actuated the jacks used for moving and uniformity of the jacking pressure indicated practically uniform coefficient of rolling friction throughout, attributed to the uniform level of the track system and the carefully arranged bearing of the entire carriage. The coefficient was found to be slightly in excess of 1½ percent, comparing favorably with a 2 percent coefficient encountered in moving a large hospital building.

Raised to new elevation

After moving to the new location, it was necessary to raise the boiler 10 ft. 11 in. and provide extensions to the existing columns for support of the structure at that height. Reinforced concrete pits 10 ft. deep were prepared at the new boiler location in advance of moving so that full length column extensions could be placed under the columns prior to raising. This scheme eliminated the need for high cribbing, increased the speed of raising and assured a safer operation. During moving, the track system for transfer of the boiler passed over these pits on heavy beams, which were supported in pockets left in the walls of the pits.

A 3-ft. thick mat of concrete over the supporting piles was used under the boiler location and on this the hydraulic jacks were placed for operation under the distributing beams, lifting the load of the structure from the track system and the runner-beam. The boiler was raised 4 in. and landed on 18½ O.D. x ½ x ½-in. high steel pipe pedestals bearing on temporary billets in the bottom of the raising pits. After the carriage used for transfer was removed two pairs of needle beams were set and welded on each column extension. Three 24-in. I-beams were welded in place transversely between columns to provide for installation of knee braces to each column extension and 12-in. I-beams were placed between columns longitudinally—followed by placing of knee braces to stiffen the column extension in both directions.

At each of the four corner columns a 10-in. I-beam was set vertically in the pit and welded in place so that its web was parallel to the column flange. From the billet plate on the bottom of the extended column a steel guide was placed so that it would rise with the boiler and run in the channel formed by the web and flanges of the 10 in. I-beam with ¼ in. clearance on three sides. This served as a fixed gage where any side "wandering" of the structure during raising could be observed and might also assist to prevent overturning of the top-heavy boiler.

At this point the boiler had been moved to its new position and lifted 2 in. for insertion of the rollers plus 4 in. for removal of the carriage structure leaving the major lift of 10 ft. 5 in. to be accomplished. Four sets of needle beams were used to effect the raise, the first three being employed for a 32-in. raise each and the last one for the remaining 29 in.

Set-up for raising consisted of 24 hydraulic screw-jacks with a 4½-in. dia. piston and a stroke of 8-¼ in. each, actuated by 12 hydraulic hand pumps. Four jacks were arranged concentrically about each of the six boiler columns, a pair of jacks lifting against a 10-in. 72-lb. H-beam bearing beneath the needle beams which was welded to the column. The group of four jacks about a column were connected by hydraulic copper tubing to two interconnected hand pumps, making it possible to individually adjust the elevation of any column separately. A crew of 30 men handled the lifting. One man was stationed in each raising pit with access to the bottom of each column and supplied with thirteen ⅝-in. steel plates 9 in. square and one plate each ½ in., ⅜ in., ¼ in. and ⅛ in. thick. These men placed the plates one at a time under the column as it was raised, the small differential in plate thickness insuring against any considerable drop in case of failure of beams or welds.

Safety provisions

At the ground level two men were stationed at each column, each man to keep the safety nuts tight on two of the hydraulic screw jacks during a raise, thus preventing a drop of more than $\frac{1}{16}$ in. in the event of failure in a hydraulic pump or connection. A crew of 12 men operated the hydraulic hand pumps—one man to a pump.

An air whistle was used to signal the strokes of the hydraulic pumps, continuing until an increment of 2 to 3 in. was attained, at which time a stop was made to level up all columns. Maximum differential permitted was ¼ in. Jacking pressures varied from

Fig. 5. Track, rollers, runner-beams distributing-beams and needles are carefully proportioned and reinforced to prevent sag or movement.

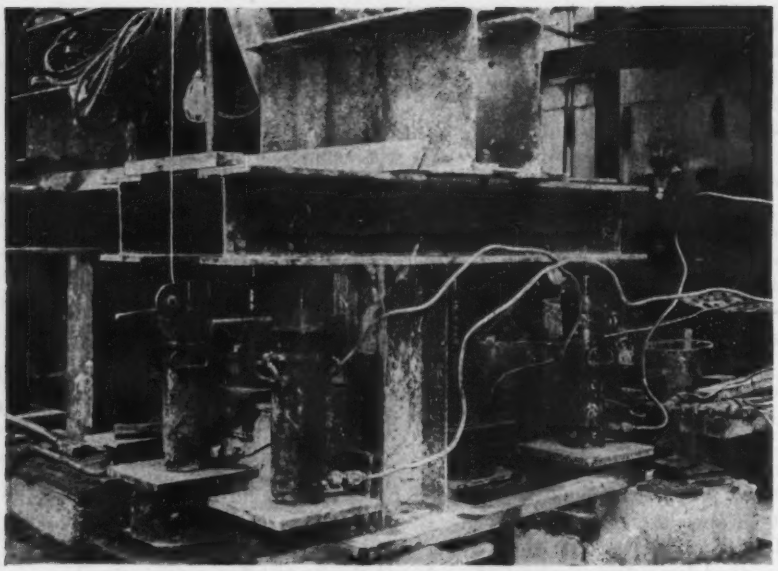


Fig. 6. Hydraulic screw-jacks (at top) used for raising are 4½-in. hydraulic piston with exterior screw-thread and collar, the latter used to constantly take up gain of jack to prevent a drop if hydraulic pressure fails. Pedestals and supports (below) are raised progressively as boiler is jacked up.

2,000 psi. for the front columns to 4,000 psi. along the rear line. Graduated steel tapes were set with their divisions at the same elevation at the start of the raise, and observed constantly by a level on each side of the boiler.

When the 8-in. extension of the jack was reached the load was held on the jack and longer sections of 18-in. O.D. pipe placed under the column extension. The columns then were landed on the pedestals, the jacks retracted and 12¾-in. O.D. by ⅜-in. thick pipe sections placed as a raised base for the jacks for a new lift.

The boiler was raised 40 in. the first day, 56 in. the second day and the remaining 29 in. was obtained easily the third day. At the end of each day's operations the pits made for the column extension were filled with high-early strength concrete to the height of the raise attained so that the full area of the pit could be used next day in case of an emergency.

A number of contingencies were considered in planning the raising operations but only one unusual item was observed. A harmonic vibration occurred when the boiler was within 19 in. of its final elevation. Immediate inspection, through a transit, set up previously for the purpose, revealed a similar vibration at the top of the boiler. The 12-in., 53-lb. columns of the boiler, while entirely sufficient for the load to be carried, were somewhat limber. The shock of the hydraulic pumps working in approximate cadence, coupled with a slight changing differential in column elevation apparently induced the vibration. Columns were stiffened longitudinally by cross braces and knees were supplemented at this level by a 6x4x¾-in. angle tie about 4 ft. from the bottom of the columns. Time between strokes for the hydraulic hand pump was lengthened, decreasing the rate of rise by one-half, following which raising was completed without further incident.

After the raising operation was completed there remained only the work of temporarily shoring the boiler to permit the setting of forms, pouring concrete for the column pedestals and then setting of billets and the four columns extensions, after which the boiler was landed. Final check by level and extensometer was made to insure that the columns were carrying their proportionate loads. All temporary steel then was removed, completing the project.

Personnel

The relocation of the Riley Boiler was executed for the U. S. Navy, under supervision of the Bureau of Yards and Docks. Rear Admiral Ben Moreell, chief of the bureau and Capt. John J. Manning, then director of construction. At the Brooklyn Navy Yard Capt. W. M. Angus was public works officer; Commander H. C. Griswold, officer-in-charge; Howard Keil, assistant; and W. Ireland, Job Inspector. The general contractors were the J. G. White Engineering Corporation; C. A. McCollough, job manager and John Boardman, job superintendent.

The engineering staff of Spencer, White & Prentis, Inc., contractor on the work described, developed the technique of raising and moving and designed the necessary structural parts. Their general superintendent was Joseph C. Weaver, job superintendent was Mike Canale and the writer was engineer in charge.

Compaction Machine Prepares Soil Samples For Stability Test

V. R. Smith
Research Laboratories, Standard Oil Co. of California

A mechanical device, developed in laboratories of the Standard Oil Co. of California, effectively compacts soil samples which are to be used as the basis for the design of flexible pavements. The device has been used extensively, in preference to other methods, for the preparation of stability test specimens of homogeneous density, grading and composition.

Studies looking to the development of such a machine were undertaken some two years ago when it appeared that currently used methods were inadequate. Several of the bearing capacity and stability tests now in use actually measure the extent of compaction of the test specimen; not necessarily the properties of deformation of the material when subjected to the type of loading encountered in actual service. Therefore, it is very important that the test specimen be prepared with a density approximating as closely as possible the density obtained in the field. It was desirable that the method of making the specimen should apply equally to fine soils, coarse aggregates and bituminous admixtures of various types. In short, it was desired to develop a laboratory compaction procedure for making test specimens that would be reliable guides to proper design for pavement constructed with the soil used in the test.

Although the method developed has been used primarily for preparing a cylinder of 4 in. dia. to be used in triaxial compression tests, it is equally applicable to the preparation of specimens for other tests, such as the California bearing ratio test, the "swell" test and for determining moisture density relationships as in the Proctor compaction test.

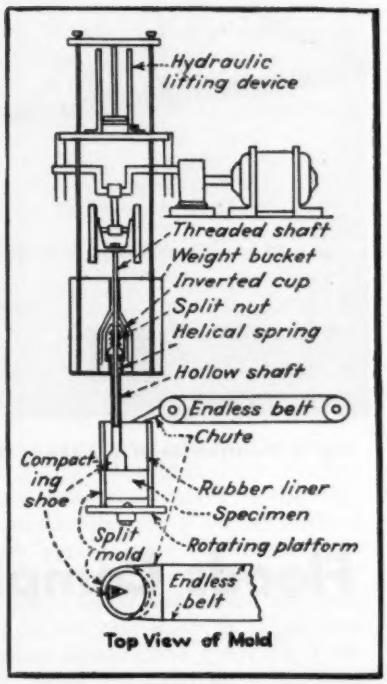
In the mechanism, of which a schematic diagram is shown in the accompanying drawing, a motor drive is so arranged that a predetermined weight is applied successively and for an equal length of time to all parts of the surface of the specimen being compacted. Material is added at regular intervals and the compacting operation is repeated on each successive layer.

As shown in the drawing, the mold for the specimen is fed from an endless belt on which the uncompacted material can be spread uniformly. Compaction is effected by successive applications of a weighted shoe, which is moved up and down at intervals, timed with partial rotations of the mold.

The weight is applied through a threaded, vertical rod working inside a hollow shaft at whose bottom is a sector-shaped shoe of 1-sq. in. area. The weight is raised and lowered by a motor through a speed reduction gear. When the vertical shaft is lowered the weight rests upon the specimen while the lower portion of the threaded rod continues downward through the hollow shaft until the bottom of the piston stroke is reached. As the rod travels upward the weight (and the compacting shoe) are reengaged and lifted clear of the specimen. While shaft and weight are in the upper portion of the stroke, the mold is rotated slightly so that when the shoe again descends its weight rests upon a new area.

The successive compacting position of the shoe really moves upward in a helical path as the result of creep, up the shaft, of a split nut actuated by a spring. Whenever the weight lifts above the shoe by a predetermined amount, the spring thrusts the split nut up to a higher position on the threads of the vertical shaft, as the result of which the weight comes to rest, after each such lift, at a slightly higher level.

Thus, in a predetermined and uniform sequence the mold is finally filled and the compacting shoe arrives at the top. It then only remains to smooth off and finish the top by overall pressure of the same unit intensity,



Illustrating method of operation of the mechanical compactor

applied by a single plunger. This uniformly distributed pressure merely finishes off the surface; extensive tests have shown that additional compaction does not result.

During the compacting procedure the endless belt and the compacting shoe are maintained at desired temperatures by electrical heaters if bituminous admixtures are being compacted. This assures uniformity and prevents adhesion to the metal parts.

The endless belt can be adjusted to feed the desired amount at controlled intervals and the weight can be changed to obtain any desired compacting pressure by adding lead weights to the bucket. In compacting specimens for bituminous wearing course design tests a compacting pressure of 335 psi. is used because this most closely approximates those densities obtained in the field with 8- to 10-ton, two-wheel rollers on 2- to 3-in. thicknesses of bituminous wearing courses. The hydraulic piston is used to lift the compacting weight while molds are changed.

Fig. 1. Construction of a highway bridge over the Mississip pi River to relieve traffic congestion nears completion.

Floods Complicate Mississippi Bridge Job

John N. Newell
Chief Engineer, Massman Construction Co.
Kansas City, Mo.

***Contents in Brief**—Erection of a large highway bridge over the Mississippi River at St. Louis during one of the worst floods on record encountered many difficulties of the first order. Construction of an erection bent on the site of a previously collapsed steel sheet cofferdam taxed the contractor's resourcefulness to the utmost.*

REGARDLESS OF EXPERIENCE, contractors often must use considerable resourcefulness and ingenuity to meet those contingencies always popping up between preparation of plans and final acceptance of the job. Such was the case in building the new highway bridge across the Mississippi below St. Louis, started before the war but just now completed. Here our firm had to battle one of the worst floods on record, when high waters bedeviled all construction operations, but caused particular trouble in collapsing the steel sheeting enclosing a sand island to carry a falsework bent in midriver. All efforts to remove the sheets that were flattened out on the river bottom failed, so finally special piles were punched through the wreckage for new bent supports. As we had completed a similar bridge across the same river at Chester, Ill., in 1942 (*ENR*, Mar. 19, 1942, p. 466) we thought we knew something about the Mississippi, but we learned a lot of new tricks on this last job.

St. Louis County, Mo., is the owner. The structure, 3,627 ft. long, crosses the river near Jefferson Barracks. The east approach connects with Illinois State Highway 3 between Dupo and Columbia, Ill. This new crossing will bypass traffic between Missouri and southern Illinois around the congested districts of St. Louis.

There are three main river spans; a center span 804 ft. and two adjacent spans 670 ft. each in length. Approach spans on the Missouri side come off of a high rock bluff and their foundations rest on solid rock. Two 84-ft. deck plate girders and two 134-ft. deck truss spans make up the Missouri approach. Approach spans from the Illinois side carry the roadway up from the lowlands on a three percent grade and across a slough before joining the main river spans. The Illinois approach consists of six 59-ft. I-beam spans and five 134-ft. deck truss spans. Piers and bents for these spans are reinforced concrete resting on concrete bearing piles. Bearing piles in the slough are enclosed in steel sheet-pile cells to guard against possible scour during high river stages.

Piers carried to rock

The main river piers are reinforced concrete, all carried to solid rock by open dredging except for the one river pier near the Missouri bank. At this pier the rock was so close to ground level that an open cofferdam was used. Generally, the river piers were started by first building a sand island en-

losed with steel sheetpiling. Steel cut-ing edges and forms were erected on ese artificial islands. Sinking of the iers was then accomplished by ex-avating material out of dredge wells ith a clamshell bucket. Foundation ock was of such a nature as to permit he final cleaning of the dredge wells y divers prior to sealing the pier ases.

The deeper of these river piers was unk 82 ft. below mean low water. bout 15,600 cu. yd. of concrete was sed in the substructure and 5,240 ons of structural steel in the super-tructure.

Troublesome river

Erection of the steel resulted in a ide variety of experiences, partly be-use the spans cross some dry land, cluding railroads and telegraph nes, a 900-ft. wide sand bar, a shal-w slough and the deep swift chan-el of the river near the Missouri ank. The contractor found himself lternately attempting to drive bear-g piles and erect falsework with a rawler crane on the sand bar, and oating a barge into the same spot a w hours later for placing willow attresses to prevent scouring of the r, all depending on the whim of the ver. Throughout the job the be-avior of the Mississippi proved to about the worst on record. During e erection of the main spans the ver reached the highest crest in 99 ears at St. Louis.

Approach spans were erected en-rely without falsework. Both 134-ft. eck trusses were assembled and riv-ed on barges, then moved into po-tion and raised with two floating erricks, one truss at a time. Ap-roach spans on the Missouri side ere raised from the ground with a 0-ton derrick after being assembled d riveted.

Main span erection

Erection of the main river spans as begun at one midriver pier. A lsework bent was constructed one nel length from the pier, bottom ords and the floor system were set p by means of a derrick on the sand r near the pier and then two travel-g derricks were set up on the floor stem back to back. Steel erection roceeded in opposite directions main-ining a balance on the pier and lsework.

The main span trusses are 30 ft. c. to c. and 110 ft. deep over the two midriver piers. All primary members in these spans are silicon steel. It was necessary to erect six bents of falsework, but not more than two bents were in place at any one time. The 670-ft. span nearest Illinois required three bents of falsework and the 804-ft. span, two. All five bents were steel towers supported by 75-ft. timber bearing piles. Bearing piles were sway braced above water with bolted timbers and below the water's surface with cables attached to the piles before driving.

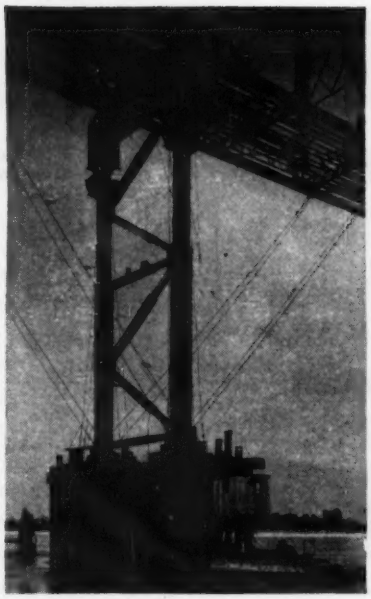


Fig. 2. Steel H-beams were driven through a previously collapsed steel sheet cofferdam on the river bed to support this erection bent located in the swift river current.

The 670-ft. span nearest Missouri required only one falsework bent, located directly in the center of the navigable channel. It turned out to be the greatest problem encountered during construction of the entire bridge. Preliminary investigation showed about 8 ft. of sand overlying solid rock at this location. The depth of water varied from 40 to 70 ft. depending on the river stage. Water was extremely swift during high river stages and a cross current made downstream navigation difficult. Two minor mishaps involving navigation past this bent during its construction made everyone aware of the hazard from boat traffic.

Sand island lost

Original plans for this falsework bent called for a sand island 60 ft. in diameter enclosed with steel sheetpiles 65 ft. long. Then 75-ft. timber bearing piles were to be driven in the sand island and the top of the cell covered with paving stone to prevent high-water scouring out the sand fill. Steel erection was scheduled so the sand island and bent would be in the river during January and February, a period when low water stages can normally be relied upon. However, during the setting and driving of the sheet pile cell the river suddenly rose 27 ft., collapsing the cell. The steel sheets flattened out on the river bed covering an area 60 ft. wide and 125 ft. up and down stream, which soon filled with sand to a maximum depth of 14 ft.

Fig. 3. Erection of the main spans was by two traveling derricks operating on the floor system and progressing both ways to maintain a balance on the supporting pier and temporary bent.

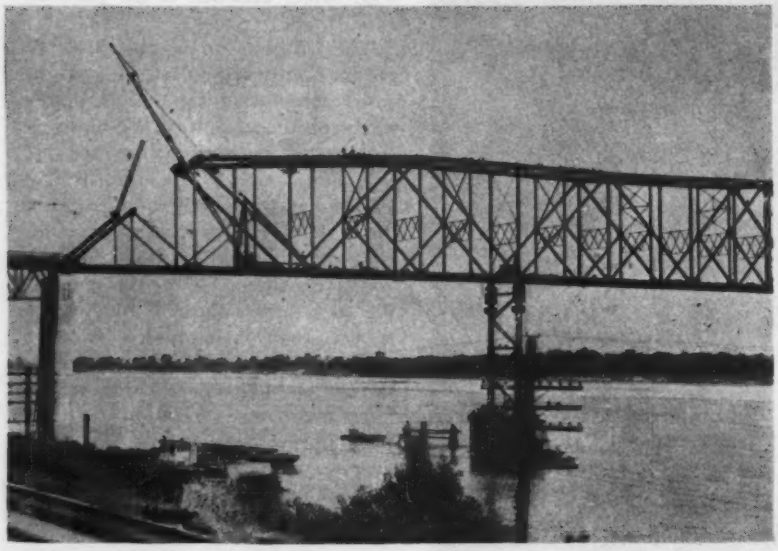


Fig. 4. An erection bent near midspan maintains the correct camber while erection of the 670-ft. truss continues by cantilevering to the pier on the west or Missouri bank.

An unsuccessful attempt was made to remove the collapsed sheets. The contractor moved in a hydraulic dredge and tried to uncover them sufficiently to permit divers to hook on at several points and rig up for a lift, but the deep, swift water foiled diving operations and this plan failed. Furthermore, the rapid infiltration of sand covered the sheets about as fast as the dredge could take the material out. Though the divers were successful in hooking onto the sheets at several points, the connections always tore out when the pull was made on the embedded sheets.

Driving falsework bent

It became apparent that removal of the collapsed steel sheet-piling was impossible. Although the sheets were too deep in the channel to interfere with navigation, it was still necessary to place a falsework bent at this point to carry the 670-ft. span during erection. The only alternate would have been to straddle the wreck with two bents space 268 ft. apart, but this would have seriously blocked the river for navigation besides increasing the cost. The area covered by the collapsed sheets was carefully investigated over a period of several weeks by extensive soundings with a steel H-beam. This probe was driven through the overburden to the steel sheets and the elevations and positions of the sheets closely noted. During this period of observation the river went on a rampage, its worst flood in history. However, there was no indication of the sheets moving or of the sand overburden changing materially.

The plan was to use 12-in. steel H-beam piling 75 to 80 ft. long for the falsework foundation, driving them through the collapsed sheets and into the underlying rock. A steel cage braced the H-beams under water, 45 ft. high with guide slots to receive each beam. The cage was assembled and placed in position, resting on the sand covering the collapsed steel sheets. Four H-beams were set in the cage first and spudded into the sand to hold the cage in correct position. A special steel spud, made by welding a cast steel point on the end of a 12-in. H-beam, was placed in each pile guide of the falsework cage and driven through the steel sheets and down to rock. In most cases there was only a single layer of sheets to drive through. However, in a few instances there were two or more layers to be penetrated because some of the sheets piled up or rolled together when the cell collapsed. After the steel-pointed stud was driven through the sheets it was pulled with a pile extractor. Then a plain-end bearing piling was set in the same guide, driven through the spudded hole and on down to rock.

Adjustable guy cables

A total of 38 H-beam bearing piles was driven to form this one erection bent which carried an erection load of 1,100 kips per truss. From the rock to the bottom chord of the 670-ft. span was a distance of 173 ft. Due to the excessive slenderness of the falsework precautions were taken against the possibility of buckling or kicking out of the bearing piles and cage. Four 14-in., H-beam piles were driven on each side of the bent, through the sheets to rock and battered in at the top. These connected with the falsework near the top of the steel bracing cage. Four 1¾-in. dia. cables were connected to the falsework at approximately this same point on each side of the bent and fastened to the span above to act as guys. Turnbuckles on the guys were adjusted continually to meet camber changes in the span while erection progressed, or to check the buckling action of the bent.

During erection of this 670-ft. span the falsework bent attempted to kick, and did succeed in moving approximately six inches, but was checked from further movement without placing undue strain on the cable guys. Erection was by cantilevering 420 ft. from a midriver pier to the single erection bent. The end of the cantilever drooped about 22 in. below camber elevation upon reaching the bent. The steel was landed on the bent, jacked up to proper elevation and erection proceeded onto the Missouri pier.

Erection of the span was rushed to completion within twelve days from the time that steel was first placed on the falsework bent. The U. S. Engineers of St. Louis and the U. S. Coast Guard put forth every effort to control and protect both navigation and the structure during this critical erection period over the channel.

Construction personnel

The contract for erecting the entire bridge was held by the Massman Construction Co., Kansas City, Mo. Sverdrup and Parcel, St. Louis, were consulting engineers. Charles W. Barnes, Jr., was resident engineer for the consulting firm, and he was assisted by Elmer C. Mosberger and Ralph V. Schmidt.

The contractor's personnel was headed by Geo. E. Owens, general superintendent, now a captain in the U. S. Engineers. Others include Harry G. Quail, superintendent of pier construction; William H. O'Donley, superintendent of steel erection, and the writer.

Norfork Dam Construction Expedited To Provide Power

***Contents in Brief**—Concrete for Norfork Dam is transported from the mixing plant to its final location in the structure by means of cableways supplemented by truck haul for a large portion of the concrete for the spillway and penstock monoliths. This latter operation consists of trucking the concrete from the mixing plant to about the midpoint of the structure with trucks equipped to pick up and set down 4-yd. buckets without the aid of other equipment. The remaining distance of travel is by the cableways. Ice the summer ice is added to the concrete for cooling purposes. A large saving is resulting from the addition of limestone dust to the mass concrete to improve its workability. Aggregates are supplied by a plant of 500-ton hourly capacity designed for a minimum of waste.*

BECAUSE OF SPECIAL MEASURES taken to expedite concrete placing, Norfork Dam is soon to be completed to provide much-needed power in northern Arkansas and southern Missouri. In addition to these special measures, the project is of interest because of the use of two 2,846-ft. span cableways—longest yet employed for this type of work; the addition of limestone dust to improve the concrete's workability; the control of the placing temperature in summer by means of ice; and because of the layout of the aggregate plant. Of added interest are the measures taken to provide flood storage, despite inability to secure the desired tainter gates.

The dam is located on the North Fork River in northern Arkansas five miles northeast of the town of Norfolk. Its concrete volume of 1,500,000 cu.yd. will be exceeded only by six other dams in the country, namely, Shasta, Boulder, Grand Coulee, Friant, Fontana, and Marshall Ford. It is a plain gravity type structure with a 2,624-ft. crest length and a maximum height of 233 ft. The first 1,676 ft. at the north end is a non-overflow section, the next 568 ft. a spillway providing an effective opening of 480 ft., while the remaining length is a non-overflow section similar to the north end. The powerhouse

U. S. Engineering Dept. photo

Fig. 1. Norfork Dam work has progressed sufficiently that the piers for the tainter gates are now being constructed, as this view from south abutment shows.

is located on the north side of the spillway at about the middle of the dam.

In addition to providing an ultimate power capacity of four 35,000-kw. units, Norfork Dam will regulate the flood flows from a 1,806-sq.mi. mountainous area with a mean runoff of about 1,800 cfs. A total of 1,983,000 acre-feet of storage will be provided, including 707,000 acre-feet for power, 732,000 acre-feet for flood control, and 544,000 acre-feet dead storage. The maximum draw-down will be 42 ft.

Power production next April

Construction of the dam started in March, 1941 and concrete placement on October 10 of that year. The original completion date, to permit storage for flood control only, was August, 1944. With America's entrance into the war, concrete placing was expedited and contracts were awarded for construction of the powerhouse and installation of the first generating unit Production of power is now expected by next April, or many months earlier than originally planned.

This progress is considered especially good in view of a total of two months working time being lost because of two floods, one in December, 1942, of 65,000-cfs., and a 74,000-cfs. flood in May, 1943. All the protective cofferdams were topped in both instances, requiring costly cleanups in the working areas. The most serious consequences, however, was the complete termination of the sand and gravel loading operations on the White River about 12 miles from the dam.

Aggregate for the concrete work is supplied by a plant of 500-ton hourly capacity located downstream from the mixing plant on the north abutment. Because sand and gravel were to be obtained from the White River and the larger aggregate from a limestone quarry a few miles upstream from the dam, the contractor considered this location for the aggregate plant most satisfactory. The plant, which is notable because of the small waste permitted, requires about 2,900 tons of sand and gravel and 1,600 tons of rock daily to permit the placing of 2,500 cu.yd. of concrete. About 65 percent of the raw material is chert river gravel delivered by railroad hopper car. The quarry stone is trucked to the plant, being fed directly to a 30-in. primary crusher.

Four sizes of coarse aggregate

Fine aggregate, limestone dust, sand and four sizes of coarse aggregate, are produced. Two correlated processing systems illustrated by the flow chart in Fig. 2 are used, one producing 3-to-6-in. aggregate and rock dust and the other three sizes of coarse aggregate and sand. Material from the primary crusher, shown at the right in Fig. 2, passes to a 72-in. rotary screen with two size of openings, 7½ and 3¾ in. Stone retained on the finer screen and passing through the screen with the larger openings is stored as 3-to-6-in. aggregate over a 9-ft. dia. batching tunnel 458 ft. long, which also passes under the sand, limestone dust and other aggregate storage piles.

The greater portion of the fines passes to a 5 x 12-ft. double-deck pulsator. Coarse stone from this unit is delivered to the belt from raw storage,

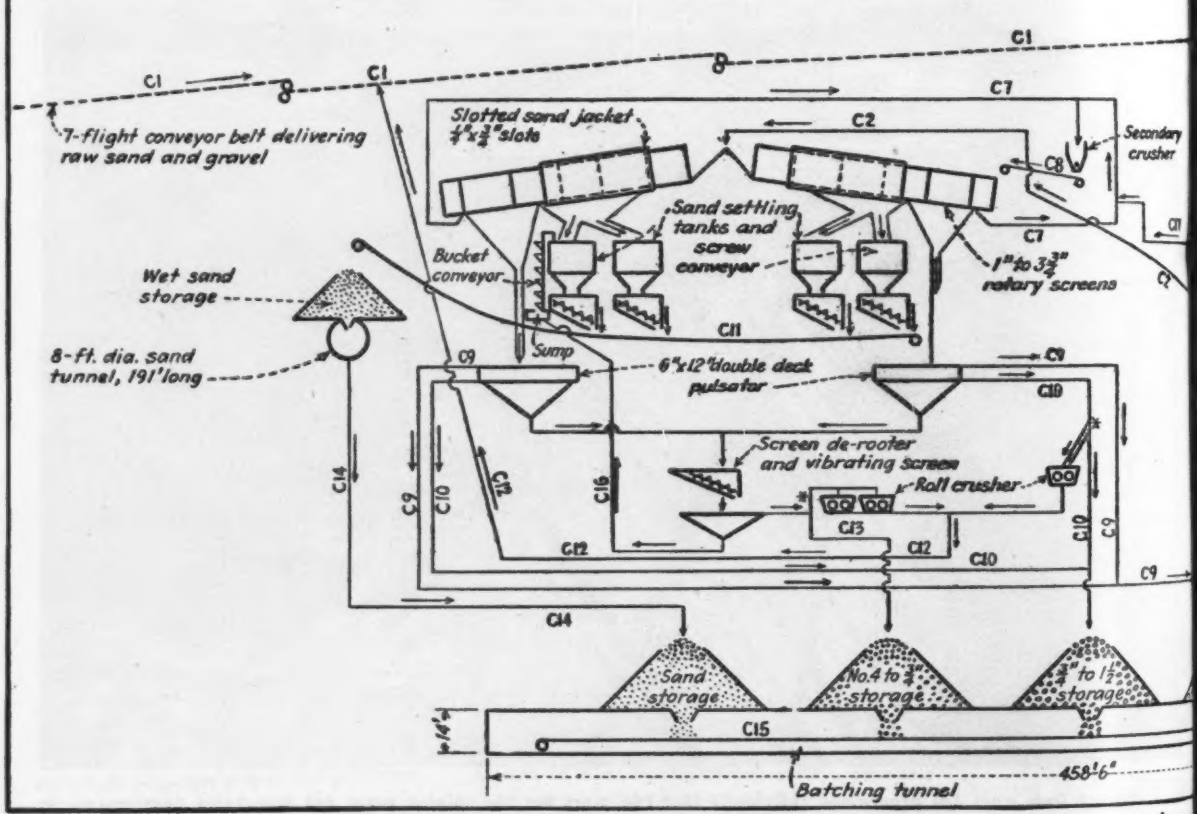


Fig. 2. Flow chart for crushing and screening plant, which has combined hourly capacity of 500 tons of aggregate, sand

hile material passing the bottom in. screen is wasted or, if satisfac-ry, by-passed to the belt from raw orage. Stone passing the 1¾-in. reens of this unit is transported to 36 x 22-in. roll crusher, the fines om which pass to an 8 x 8-ft. ball ill of 8 tons hourly capacity, where e required limestone dust is pro-uced. The coarser material is deliv-ed to the 36-in. belt from the raw ggregate storage.

River sand and gravel also are de-ered to the raw storage pile, being nsported from the railroad siding that point by a seven-flight, 42-in. lt conveyor, 1,352 ft. long. A 36-in. lt located in a 9½-ft. dia. tunnel out 260 ft. long beneath the raw orage delivers this material to two x 22-in. rotary screens. Stone sing through the larger screen ntinues to a 6 x 12-ft. double-deck lsator. This unit, with the aid of e other equipment shown on the w chart, produces three sizes of ggregate, 3-to-1½ in., 1½-to-¾ in., and in. to No. 4, which are stored over e batching tunnel. Material passing e sand screen goes to four 10 x 7½-ft. wet sand classifiers, the wet sand being stored above an 8-ft. dia. tunnel 191 ft. long. Once drained, the sand is transported to the sand storage pile over the batching tunnel by a 36-in. belt conveyor about 260 ft. long.

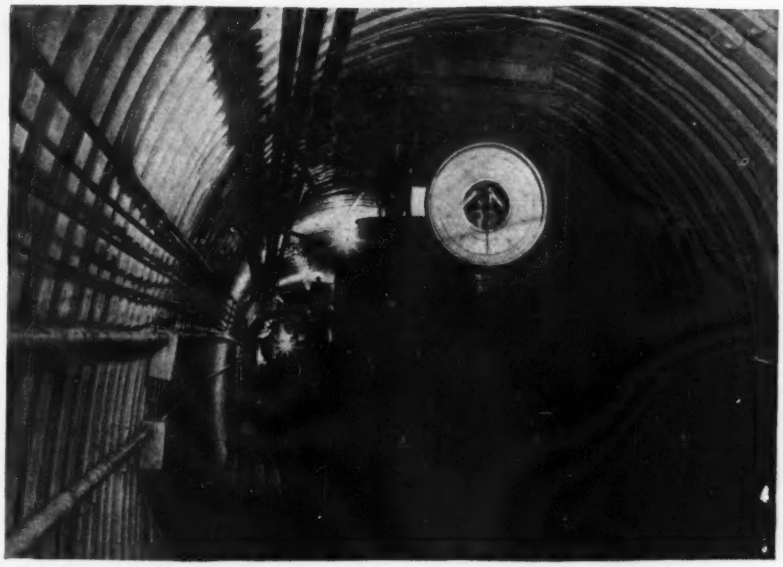
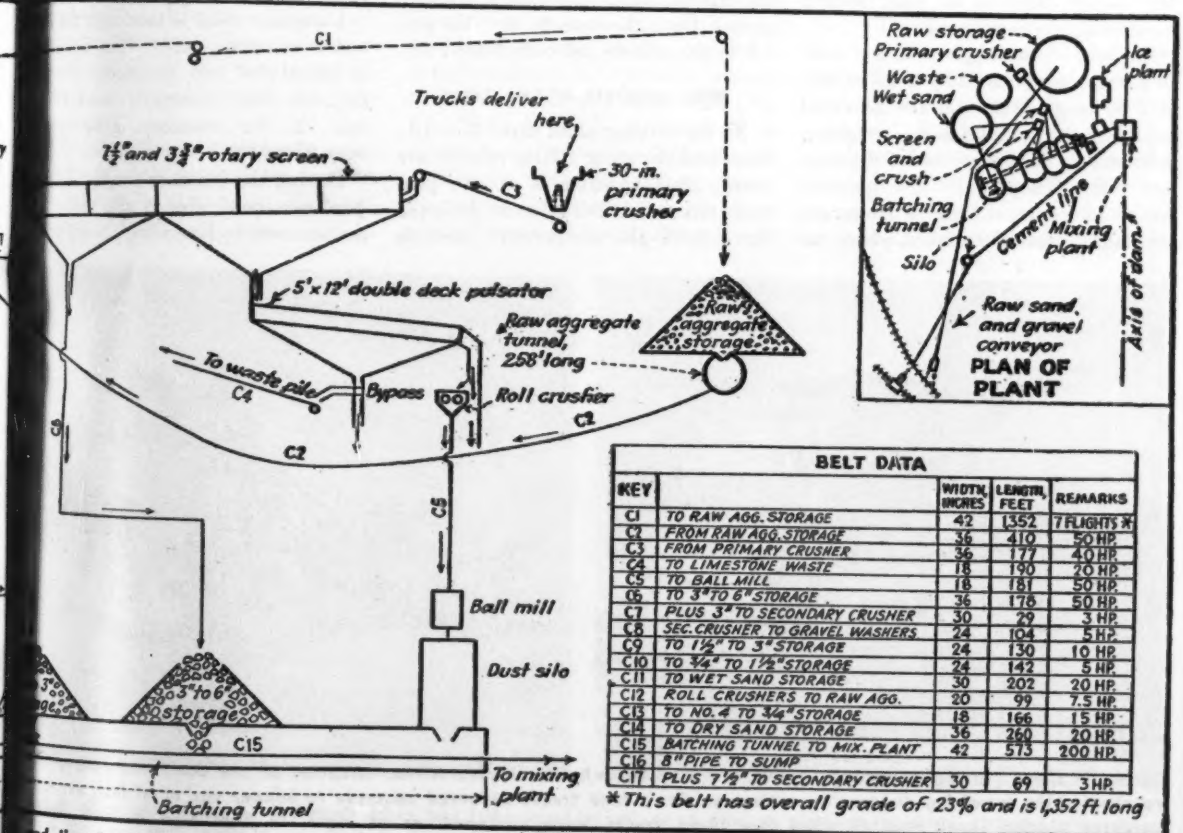


Fig. 3. Delivery of materials to 42-in. belt conveyor in 9-ft. tunnel below aggregate and sand storage is controlled by automatic weighing batchers.

Flexibility of the plant permits either or both the chert pea gravel and the 1½- to ¾-in. aggregate to be put through the rollers for making



BELT DATA

KEY		WIDTH, INCHES	LENGTH, FEET	REMARKS
C1	TO RAW AGG. STORAGE	42	1352	7 FLIGHTS *
C2	FROM RAW AGG. STORAGE	36	410	50 HP.
C3	FROM PRIMARY CRUSHER	36	177	40 HP.
C4	TO LIMESTONE WASTE	18	190	20 HP.
C5	TO BALL MILL	18	181	50 HP.
C6	TO 3" TO 6" STORAGE	36	178	50 HP.
C7	PLUS 3" TO SECONDARY CRUSHER	30	29	3 HP.
C8	SEC. CRUSHER TO GRAVEL WASHERS	24	104	5 HP.
C9	TO 1½" TO 3" STORAGE	24	130	10 HP.
C10	TO ¾" TO 1½" STORAGE	24	142	5 HP.
C11	TO WET SAND STORAGE	30	202	20 HP.
C12	ROLL CRUSHERS TO RAW AGG.	20	99	7.5 HP.
C13	TO NO. 4 TO ¾" STORAGE	18	166	15 HP.
C14	TO DRY SAND STORAGE	36	260	20 HP.
C15	BATCHING TUNNEL TO MIX. PLANT	42	573	200 HP.
C16	8" PIPE TO SUMP			
C17	PLUS 7½" TO SECONDARY CRUSHER	30	69	3 HP.

* This belt has overall grade of 23% and is 1,352 ft. long

nd limestone dust. Flexibility of the plant permits the chert pea gravel to be put through the rollers to make sand.

TABLE I — TYPICAL 4-BAG MIX OF MASS INTERIOR CONCRETE

Item	Weight, lb.
Cement	376
Water	202
6 to 3 in. aggregate	720
3 to 1½ in. aggregate	640
1½ to ¾ in. aggregate	584
¾ in. to No. 4	527
Sand	1,055
Production	27 cu. ft.

TABLE II——TYPICAL 3-BAG MIX OF MASS EXTERIOR CONCRETE

Item	Weight, lb.
Cement	282
Water	194
6 to 3 in. aggregate	698
3 to 1½ in. aggregate	682
1½ to ¾ in. aggregate	693
¾ in. to No. 4	354
Limestone dust	80
Sand	1,130
Production	27 cu. ft.

TABLE III—COMPRESSIVE STRENGTH OF 6 X 12-IN. TEST CYLINDER

Mix	Type of Cement	Number of Cylinders	Comp. strength, psi. 7 day	28 day	6 mo.
3-bag	Low-heat	1,100	956	3,043	5,496
3-bag	Moderate-heat	681	1,704	3,790	5,590
4-bag	Low-heat	387	1,445	4,797	7,737
4-bag	Moderate-heat	171	2,977	6,015	7,631

Note: Six-month strengths average of eighteen test cylinders, except for 4-bag mix of moderate-heat, which is based on fifteen cylinders.

sand. The crushed material is conveyed to raw aggregate storage and is processed along with the river sand. The use of crushed sand is dependent upon the coarseness of the river sand. The addition of crushed stone is permitted only if the resulting product has a fineness modulus of 3.0 or less. Norfork Dam is considered one of the largest dams to be built with a sand of this type mixture.

Delivery of dust aggregate, and sand to the mixing plant is by a 42-in. belt 573 ft. long. Materials are delivered to the belt by automatic weighing batchers in the tunnel under the storage piles. These units are operated by remote control from a room immediately above the mixers, where the amount of water and cement is also regulated. Water is obtained from the North Fork River, and since the supply is generally free of silt, no treatment is necessary.

Cement is delivered in bulk by railroad cars and stored in a 5,000-bbl. silo a short distance downstream from the dam and in three 250-bbl. bins at the mixing plant. The cement is transported from the cars to the silo and on to the mixers by compressed air.

Mass concrete of two types

At the mixing plant three 4-cu.yd., front-end-charging tilting mixers are used. Mass concrete is of two general mixes. A 3-bag mix designed for a 2,000-psi. compressive strength at 28 days is used for the interior of the dam, and a 4-bag, 2,500-lb. concrete for a 5-ft. thick layer at both faces. Tables I and II indicate the proportions of cement, water and aggregate required for a cubic yard of each type of concrete.

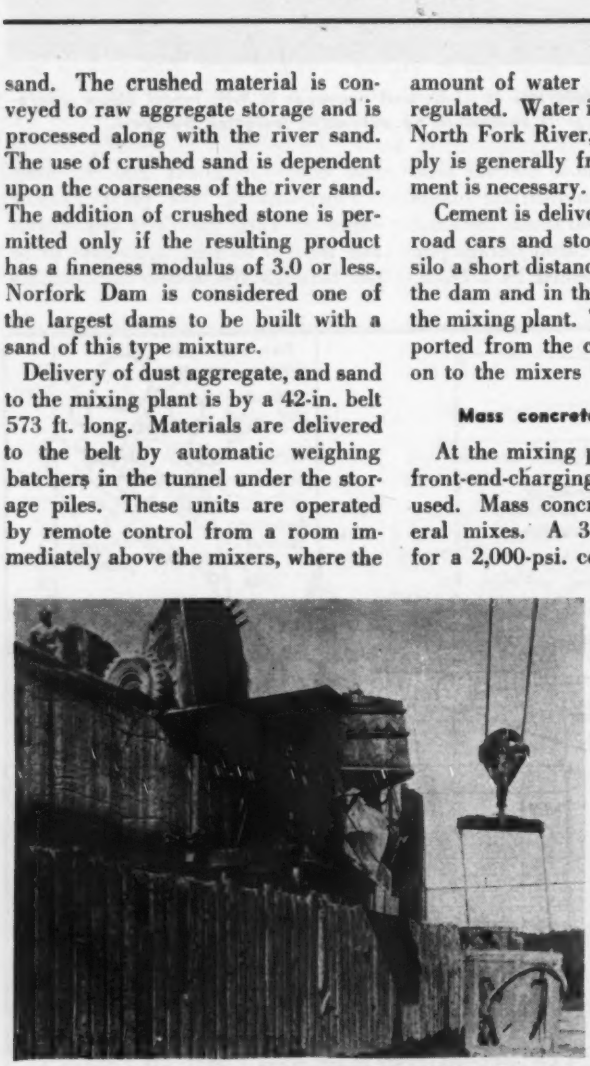
Mixing time 2½ min.

The mixing time for both mixes is 2½ min. They are delivered with a slump of from 1½ to 3 in. Laboratory tests of 6 x 12-in. cylinders of concrete, wet screened to remove all material larger than 1½ in., showed both mixes to have a much higher compressive strength than required. A summation of test results between Oct. 1, 1941, and Nov. 1, 1943 is given in Table III.

Low-heat cement is used in the summer and moderate-heat cement during the winter. The original plan was to use the low-heat type throughout the year, but the first winter's experience showed this plan unsatisfactory. The concrete, although placed at a minimum temperature of 45 deg. F., failed to set as quickly as was expected, which delayed stripping of the forms and prevented placing of the concrete at the required rate.

Limestone dust is used with the interior concrete only. This material is added for two purposes: (1) to improve the concrete's workability and (2) for economy, a saving of over $700,000 being expected.

During the summer crushed ice and ¾-in. maximum size is also added to the concrete to lower the placing tem-



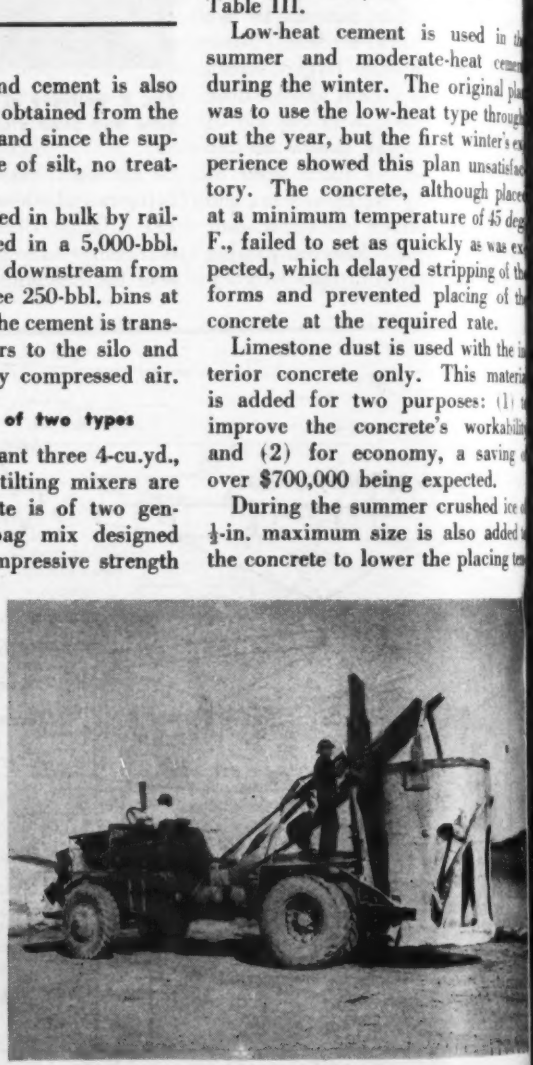


Fig. 4. To speed placing operations, trucks are used to deliver concrete to the midpoint of the dam, from where it is transported the remaining distance by cableways. For a time trucks delivered concrete to hopper car as at left, but increased placing speed resulted when four 10-yd. trucks were equipped, as at right, to haul 4-yd. buckets. Trucks pick up and set down the buckets without the aid of other equipment.

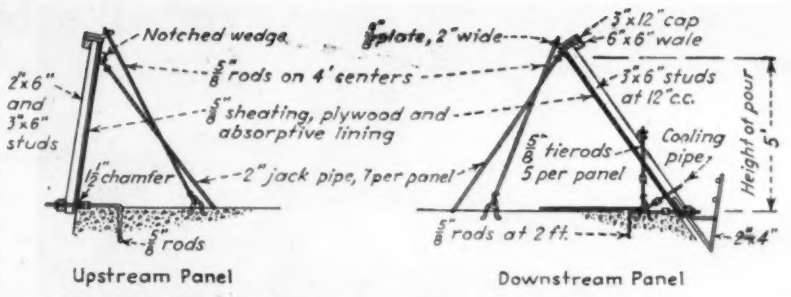
erature to 67 deg. F. or less. The ice produced in 300-lb. blocks by a ant of 90 tons daily capacity lo- ted near the mixing plant. After ing crushed, the ice is placed on 42-in. belt delivering the sand d aggregates.

Use of ice for six monthe last sum- er revealed that addition of 100 lb. a 4-cu.yd. batch will lower the cing temperature 3 deg. F. At one ne as much as 600 lb. of ice was ed per 4-yd. batch. The mixing wa- was reduced accordingly.

Cableways of record length

The concrete placing facilities origi- lly installed consist of two, 2,846-ft. bleways, which are considered of cord span for this type of work. e cables are 2¾ in. in diameter and the locked-coil type. They extend m a single 150-ft. head tower high the north abutment behind the mix- g plant to two 105-ft. tail towers on south abutment. The latter towers erate on rails of sufficient length permit the cableways to place all ncrete for both the dam and the werhouse. Hammerhead cranes re studied for placing the concrete, t the cableways were considered re economical for the original plac- g schedule, since their installation uld cost much less than construc- n of the necessary trestle for ham- rheads.

When the allowed time for complet- g the dam was reduced, the contrac- had to speed placement, which pre- usly had not been much over 57 cu.yd. per hour in the spillway section, where the bulk of the concrete is required. Special methods were developed to transport the concrete for the first 1,450 ft. or a short distance beyond the midpoint of the dam by other than the cableways, which were then used to transport the concrete for the remaining distance.



Note: Panel for vertical face similar to upstream panel, except bottom ties are on 30-in. centers, top ties on 5-ft. centers, and jack pipe at approx. 8-ft. on centers
Studs on upstream panel are 3"x6" on 12-in. centers; 2"x6" at 15" c.c. on vertical panel

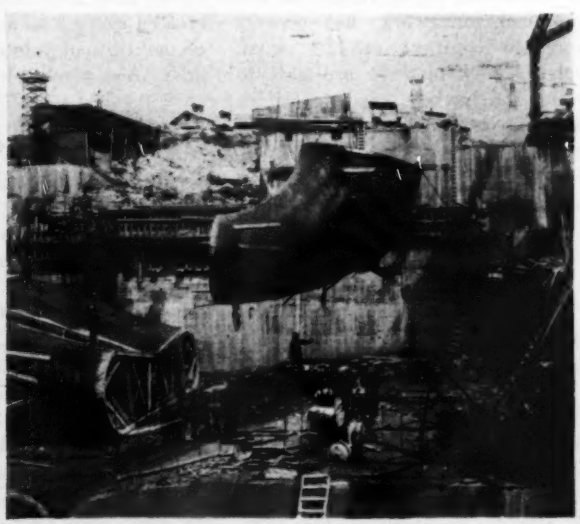
Fig. 5. After much study forms of 1 x 6-in. sheathing on 2 x 6-in. studs and supported as above were chosen. With frequent reuse of the forms the surface next to the concrete became rough and had to be covered with plywood.

Hopper car first used

An early arrangement was to deliver the concrete to the midpoint by end-dump trucks, which supplied a transfer hopper car operating on rails transverse to the axis of the dam (Fig. 4). The car was located at such an elevation that trucks could dump into it directly. This procedure speeded operations sufficiently that 80 cu.yd. could be placed hourly in the spillway portion. A secondary benefit was a reduction in the wear on the cableways and resultant shut-downs for repairs.

The transfer car had been in service about nine months when highwater washed away the truck ramp leading to the central portion of the dam. When this occurred, the car was removed, and this part of the dam and the north end, which was also low, were raised to about an equal elevation. Transportation of concrete to the midpoint by truck was then resumed, but a unique and more economical method of hauling the concrete was used. Four 10-cu.yd. trucks were equipped as shown by Fig. 4, each to haul a 4- cu.yd. bucket filled with concrete.

Cost of the lifting attachment for



. 6. After the forms for the draft tubes had been constructed on a timber platform a short distance downstream m the dam, they were transported to the desired location in two sections by the cableways.

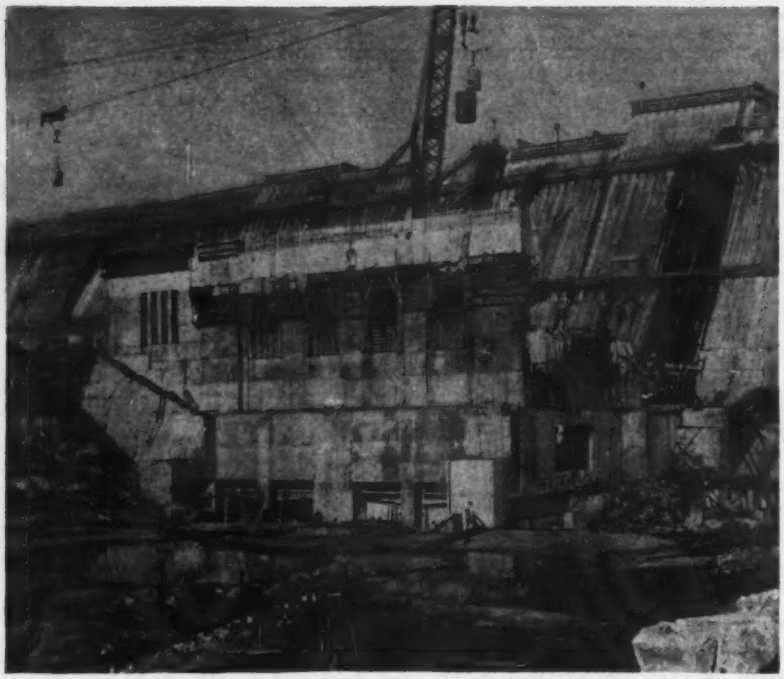


Fig. 7. Reinforced concrete powerhouse now under construction will house two of the four 35,000-kw. generating units ultimately to be installed. The building is being constructed with the two cableways aided by a stiff-leg derrick with a 180-ft boom.

each truck was about $500. A steel boom roughly 14 ft. long was installed so that its outer end could be raised by the hydraulic jack of the truck. Equipped in this manner, the trucks pick up and set down the full buckets without the aid of other equipment.

Use of the trucks requires that the monoliths of the north end of the dam over which they operate be kept at an even elevation, which results in less economical form-work, but permits placing to continue at 120 cu.yd. hourly. The cableways are able to pick up the buckets near the center of the dam as easily as at the central mixing plant.

The dam is being constructed in monoliths of about 48 ft. average width. Pours of 5 ft. maximum height are permitted. The forms consist of 1 x 6-in. sheathing nailed over 3 x 6-in. studding on a 1-ft. 3-in. spacing covered by ¼-in. plywood and absorptive paper. The latter eliminates the need for rubbing the concrete. Early in the work the paper was placed directly over the 1 x 6-in. lumber, but in frequent reuse of the forms the surface next to the concrete became rough. To overcome this difficulty, the plywood was added over the sheathing.

All the forms are made in panels 6 ft. high. The panels for the outer faces are 48 ft. long and those for the vertical faces 20 ft. They are supported as shown by Fig. 5. Hand hoists are used to raise the forms as work advances.

All concrete is vibrated in place. Curing is by a water spray.

On the downstream face of the dam 1½-in. deep horizontal chamfers are created every 5 ft. and 2-in. chamfers at the vertical joints between monoliths. A concrete pleasing in appearance results.

Temporary wall added above crest

Closure of the dam to permit storage of water occurred June 18, 1943, and early in the year work had progressed sufficiently that the piers were being constructed to support the eleven 28 x 40-ft. tainter gates for the spillway section. Since structural steel to fabricate the gates could not be obtained, a temporary reinforced concrete wall, 5 ft. thick at bottom, 2 ft. thick at top, and extending 13 ft. above spillway crest is being constructed along the spillway section of the dam. This wall will provide adequate flood storage until the tainter gates can be obtained and installed.

Construction of the powerhouse also is well advanced. It is 78 x 167 ft. in plan, or sufficiently large to house two of the four 35,000-kw. generating units ultimately to be installed. The original design was a steel-frame structure, but when structural steel became so critical a reinforced-concrete building, except for the steel roof trusses was decided upon. For the powerhouse construction a 4-bag concrete mix free of limestone dust is employed.

One generator being installed

At the present time only one generating unit is being installed. However, two 18-ft. dia. steel penstocks leading from the dam to the powerhouse are in place. Only the first few upstream sections of the other two penstocks have been built into the dam.

As of December 1, a total of 1,300,000 cu.yd. of concrete had been placed, some at the rate of 4,350 cu.yd. per day. Power production is scheduled to start April 15. This progress has been obtained despite a limited supply of both skilled and common labor, the contractors' crews numbering between 800 to 1,000 men. Three 8-hr. shifts are worked six days a week.

Those in charge

The Norfork flood control and power development is estimated to cost about $25,000,000. It is being constructed under the supervision of the Little Rock Engineer District of the U. S. Engineers. This office is headed by Lt. Col. William A. Davis as district engineer, who recently relieved Col. A. M. Neilson. The design of the structure was accomplished under the supervision of Lt. Col. G. R. Schneider, chief of the engineering division, Little Rock district office. Construction is proceeding under the supervision of W. W. Ralphe, chief, civil operations division, with Capt. John L. Kemple in charge in the field as resident engineer, assisted by Roy F. House as chief of construction.

Utah Construction Co., Ogden, Utah, and Morrison-Knudsen Co., Boise, Idaho, are the general contractors. For this organization B. Williams is project manager, John Reed, assistant project manager, John Barry, office manager, and H. P. O'Hagen, construction superintendent on the job.

Concrete Bridge Girders Reinforced With Old Steel

N. C. Raab
Senior Bridge Engineer, California Division of Highways

SCRAP STEEL OF UNUSUAL FORM was utilized in a highly effective manner in a reinforced concrete bridge recently built on a West Coast highway. A pair of steel girders 110 ft. long and originally 9 ft. 3 in. deep, had been cut in two longitudinally, to facilitate dismantling, making four sections 110 ft. long and about 4 ft. 7½ in. deep. Despite the consequent rating as "scrap" these four girders were used as reinforcing for the concrete beams of a highway bridge having a central span of 80 ft. and two cantilever arm approaches of 15 ft. each.

The new structure has two 25-ft. roadways separated by a 4-ft. median strip. Two 6-ft. sidewalks are on the outside of the roadways. The bridge was designed for 20-ton trucks with 12-ton trailers (designated as an S-20-12 loading) and a uniform loading of 60 lb. per sq.ft. on the sidewalks. These steel girders were not only used for the reinforcing of these four concrete beams but they acted as falsework for the erection of all the concrete superstructure. Since it would have been difficult and costly to cover the flanges of the steel girders, they were left exposed on the underside of the beams.

The two pieces that consisted of half the web and the bottom flange (of the original girder) had four cover plates, all 18 in. wide and varying in thickness from ½ to ¾-in. The other two (from the top half of the original girder) each had three flange plates. In their new positions all flanges were on the bottom of the concrete beams.

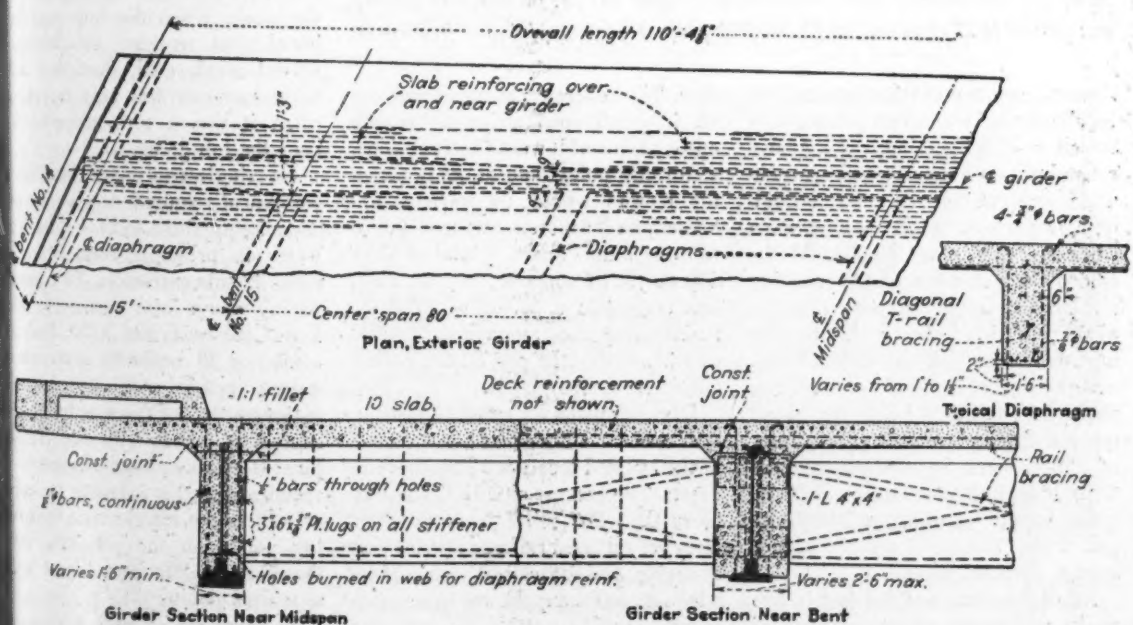
In order to take the erection stresses, 4x4x½-in. angles, 16 ft. long (salvaged from the floorbeams of the old girders), were welded to the upper edge of the web over the two supports. These flanges were so placed that of the 16 ft., 9 ft. extended from the support into the center span and 7 ft. into each cantilever arm. Additional stiffeners were required on the webs of the plate girders at these reaction points. Lugs were welded, not only to the stiffeners but to the upper surfaces of the flanges, in order to bond the concrete to the steel girders. Transverse diaphragms stiffened the beams at the quarter points of the main span and at the ends of the cantilever arms. These diaphragms were reinforced with old railroad rail.

Since the steel girders were devoid of flanges on the upper part of the web, a temporary false work bent was employed at the center of the 80-ft. span to help carry dead load during erection. All forms for the concrete work were suspended from steel bars welded temporarily to the lower flange of the steel girders.

The structure was analyzed as a composite beam and, because the depth-to-span ratio was small, compression steel was used in the slab at the center of the 80-ft. span.

Width of the concrete girders was varied, in accordance with shear requirements, from 1½ to 2½ ft. This feature could be arranged in a simple manner because of the ease with which greater width could be provided in forms that were suspended from the steel girders. The horizontal shear, a bug-bear of most composite beams, was cared for conveniently by the stiffeners on the steel girders.

Designs were prepared by the California Division of Highways, F. W. Panhorst, bridge engineer; J. W. Green, southern representative, bridge department. The contract was carried out by the Ralph A. Bell Co., Los Angeles.



Half section through center-span deck and part plan of the new bridge utilizing old steel girders.

Fig. 1. In typical paving operations a pair of 1½-cu.yd. mixers dumped into a 25-ft. lane.

A Paving Record on the Desert

***Contents in Brief**—Despite difficulties of transportation to a remote location on a Nevada desert, labor scarcity and weather that included wind, cold, dust storms and snow, more than 111,000 cu. yd. of concrete paving was placed in 27 days and an $8,000,000 project was completed in five weeks.*

UNUSUAL SPEED WAS MADE late in 1943 on all parts of a contract job for construction of a bombing and gunnery range built on a desert site in Nevada under supervision of the U. S. Engineer Department. The project as a whole, costing about $8,000,000, included the extension of two existing airplane runways in which about 67,000 sq.yd. of new asphaltic paving was required, a 600x5,200-ft. concrete apron, 10,000 ft. of taxiways, about 140 military buildings of all types and sizes (including a hangar of 160-ft. span on concrete foundations, built in 30 days), a 9-mi., 8-in. water supply pipeline, a 2,000,000-gal. water storage reservoir and a sewage disposal system.

All of this work was finished in five weeks, with troops occupying some of the buildings ahead of completion date. The concrete pavement was not all in continuous strips as in the apron; some of it was at intersections, at turning points and at spots where the motors would be warmed up. Sometimes concrete mixers were working a mile apart. A total of 111,406 cu.yd. of concrete, in 9-in. slab, was poured in a period of 27 days, maintaining an average of 4,000 cu.yd. per day. In one 24-hr. period 6,890 cu.yd. was placed.

Devising plans for speedy construction was not a simple matter because of the isolated location on the Nevada desert. The nearest city of any size is more than 200 miles from the site. Only very limited railroad service was available, and the nearest source of an adequate water supply was nine miles away.

Because of Nevada's sparse population most of the labor had to be p curred in cities along the coast transported to the site expressly the work. When the imported la found that working conditions volved wind, cold, dust and sn labor turnover was very heavy, often it was a serious problem keep the job going.

No single contractor had all equipment required; it was necessa to pool equipment and to sublet. Th were six principal contractors some 22 subcontractors. The concr paving was a joint venture in wh J. A. Casson Co. and N. M. Ball S combined in order to pour the quired yardage within 30 days. T major portion of this was in the pa ing apron 600 ft. wide and 5,200 long. However, concrete base also specified for the warming up ap as well as the intersections and t ing points on the runways. Se therefore, had to be made at wi separated points.

To carry out so large a paving in a short time much equipment

Fig. 2. Completing the last of the concrete paving in which 111,406 cu.yd. was placed in 27 days.

e assembled. The list included ten n.yd. concrete pavers, 14 power els, 4 draglines, 67 pieces of h-moving equipment (tractors, lozers, carrying scrapers, power ers, etc.), 35 water wagons, 100 rete batching trucks, 25 portable ing plants, 7 crushing plants and ncrete batching plants.

nd and gravel were conveniently lable for the concrete aggregate to get the right combination of , the contractor reports that 60 ent of pit run materials had to be ed. Sufficient equipment was pro- to maintain a continuous sup- at a rate to complete the pouring e 30-day contract period. Stock- were made in such a way that lines (occasionally aided by bull- rs) could move the material to ing bins. Cement was delivered stored in bulk.

uring cold weather mixing water heated to 200 deg. F. to insure g concrete into place at a tem- ture that would prevent freezing. this purpose a battery of boilers et up, the capacity of which was gal. per min. at the 200-deg. tem- ture.

e original runways at this site h were merely extended in length e project here described) con- of asphalt paving on well-compacted soil. It was decided to make the extensions, of 1,500 and 2,500 ft. respectively, of 3-in. asphaltic paving laid on a well-rolled earth base. Facilities were accordingly provided for carrying on this work under a contract entirely separate from the concrete paving operation. On this asphaltic paving job some 32,000 tons of hot plant-mix material was used.

Work on the Casson and Ball contract was under the direction of Stanley A. Ball, project manager; L. G. Crowe, general superintendent and R. H. Hapgood in charge of concrete construction. A. Teichert & Son, Inc., by whom the asphaltic surfacing was laid, was represented on the job by D. G. Hall, superintendent, and A. H. Teichert, project manager.

The project was carried out under the Sacramento office of the U. S. Engineer Department, Col. J. C. Hunter, district engineer; Henry M. Rich, head engineer and J. E. Kitchen, area engineer on the project.

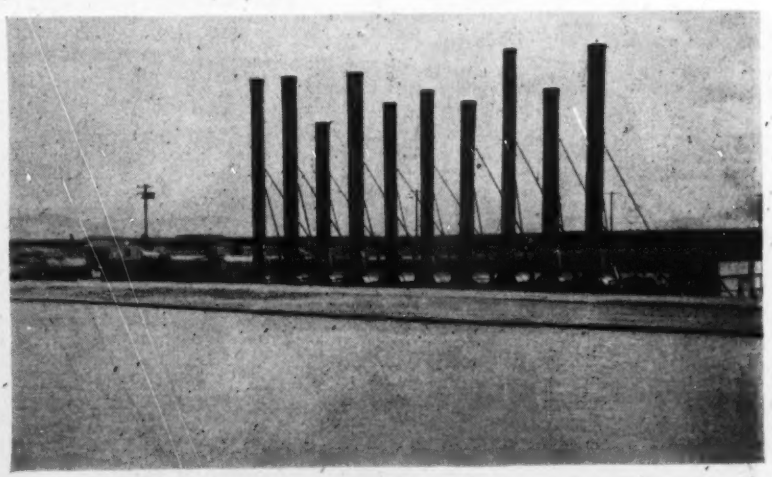


Fig. 3. Winter concreting required a set up to heat 300 gal. of water per minute to 200-deg. F. Here the necessary battery of boilers forms a background for a 2,000,000-gal. surface storage reservoir.

Cross Hair Adjustments of Instruments

David H. Crater
Instructor in Civil Engineering, Princeton University

IN DESCRIBING the adjustment of the cross hairs in an exterior-focusing telescopic line of sight, most surveying textbooks mention only briefly the difference in the directions of movement of the cross hairs between erecting and inverting telescopes. By means of a few simple sketches these differences can easily be illustrated and the problem clarified. The principle is identical in application for an engineer's transit and for wye and dumpy levels. The following description of the proper movements of the cross hairs is written for: (1) The reader who knows the adjustments, but wants to understand why the cross hairs are moved as they are, or for (2) the instrumentman who by reading a good surveying text along with this article, could not only understand what the adjustments are and how they are performed but also *why* the cross hairs are moved in the required directions the instructions indic

A telescopic line of sight is de mined by the intersection of the cr hairs and the optical center of the jective lens. The line of sight is mo by shifting the cross hair ring up down and to the left or right. In line of sight at the cross hairs of telescope the image appears inver and left for right. An erecting e piece erects the image seen by the to its actual position on the grou an inverting eyepiece permits the verted image at the cross hairs to p unchanged to the eye.

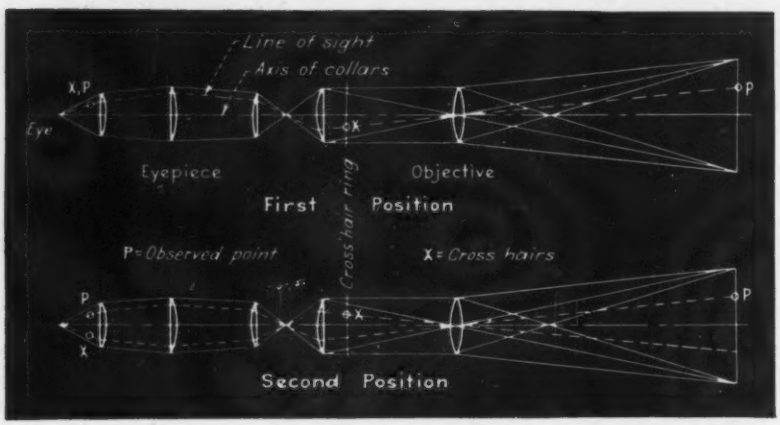


Fig. 1. For an erecting instrument the cross hairs must be moved in the opposite direction from the desired movement of the line of sight.

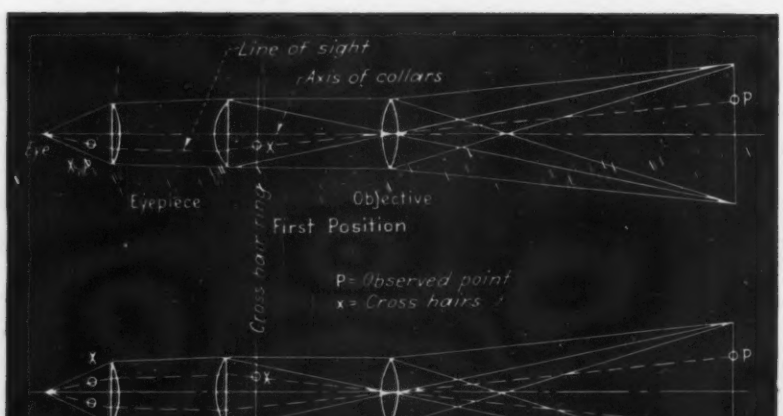


Fig. 2. With an inverting instrument shift the cross hairs in the same direction it is desired to shift the line of sight.

Adjustment of erecting instrume

Adjustment of the wye level w an erecting eyepiece can best be plained by reference to Fig. 1. make the line of sight coincide w the axis of the collars, the cross h are sighted on Point *P* as in the F Position, which is a side view of erecting telescope that needs adj ment. The horizontal cross hair, i cated by *X*, is below the axis of collars, and thus Point *P* is above axis. The line of sight therefore po upward.

The telescope is next inverted, c ing the line of sight to point do ward. This condition is illustrated the Second Position in Fig. 1. horizontal cross hair now appears low Point *P*. It is therefore evid as shown by Fig. 1, that to make line of sight coincide with the axi the collars the horizontal cross h must be lowered until it appears come half way back to Point *P*.

In the adjustment of the engine transit to make the line of sight p pendicular to the horizontal a consider Fig. 1 as a plan view of telescopic line of sight. Since Sec Position in Fig. 1 shows that the of sight must be moved to the left toward Point *P*, it is evident that vertical cross hair, indicated by must be moved to the right.

If a wye level with an inverting piece is to be adjusted, consider Fi as a side view of the telescope. In

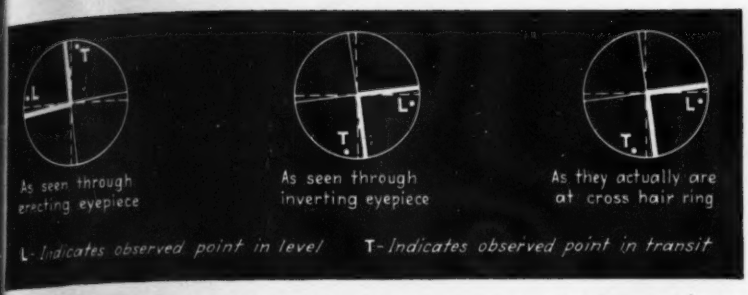

As seen through erecting eyepiece
As seen through inverting eyepiece
As they actually are at cross hair ring
L-Indicates observed point in level
T-Indicates observed point in transit

Fig. 3. For both erecting and inverting instruments the cross hairs are rotated in the same direction in which a rotation of the line of sight is desired.

case Fig. 2 indicates that the horizontal cross hair must be lowered to make the line of sight coincide with the axis of the collars. In the same way, if Fig. 2 is considered to be the plan view of a transit telescope with an inverting eyepiece, the drawing would indicate that the vertical cross hair must be moved to the right to make the line of sight perpendicular to the horizontal axis. Thus, with an inverting type of instrument the cross hairs must be shifted in the same direction in which the line of sight is to be moved.

Rotation of the cross hairs

In the adjustment of the level to make the horizontal cross hair lie in a plane perpendicular to the vertical axis, the relative position of the cross hairs and the observed point as seen through the level is assumed as indicated in Fig. 3. Note that one-half of each cross hair is drawn heavy for the purpose of illustration. Study of Fig. 3 reveals that the line of sight in this case must be rotated clockwise toward the observed point for either type of eyepiece and that the cross hair ring itself should actually be rotated in this direction to make the proper adjustment. The same adjustment would be required with the engineer's transit to make the vertical cross hair lie in a plane perpendicular to the horizontal axis.

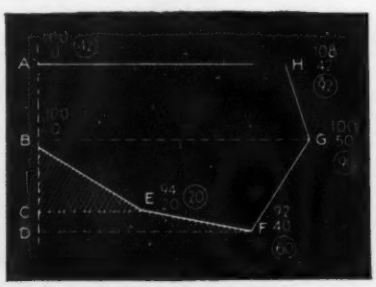
The following two rules of adjustment should be remembered: (1) In an erecting instrument, move the cross hairs in the opposite direction from which the line of sight is to be shifted, and in an inverting instrument move the cross hairs in the same direction as it is desired to move the line of sight, and (2) rotate the cross hairs in the same direction as it is desired to rotate the line of sight for both an erecting and an inverting instrument.

Earthwork Computations by Use of a Mechanical Calculator

Aziel LaFave
Assistant Engineer, Office of Project Engineer, Pine Camp, N. Y.

A mechanical calculator may be used for rapid earthwork computation by the end-area method. Origin of the method is unknown, but it was introduced at our office by Lt. Wm. A. MacLendon of the Corps of Engineers. Upon making inquiries I found the method not commonly known.

The procedure is of the same principle as the double medirian distance method for computing acreages. For illustrative purposes consider the Figure *ABEFGHA* of accompanying sketch. At each point, the numerator is the elevation of that point; the denominator is the distance from the reference line; and the numeral encircled is the number put on the keyboard at each operation. Point *B* is a point on the reference or base line.



End section for illustrating earthwork computations with calculator.

The general procedure followed is: Enter on the upper dial of the calculator, the elevation of the point on the reference line; then, on the keyboard, put on the number which is the distance of the next point from the reference line *plus* the distance of the previous point from the reference line; then run the upper dial to the elevation of this point.

To find the double area of triangle *BCE:*

1. On the upper dial, add the elevation 100, of Point *B*.

2. On the keyboard, add 20, which equals 20, the distance *E* is from the reference line, plus *O*, the distance of *B* is from the reference line.

3. Run the upper dial to the elevation of *E*, 94.

The double area of triangle *BCE* will then appear as a minus quantity on middle dial (—99880).

To find the double area of trapezoid *CDFE:*

1. On the keyboard, add 60, which equals 40, the distance of *F* from the reference line, plus 20, the distance *E* is from the reference line.

2. Run the upper dial to El. 92.

The accumulated minus areas of triangle *BCE* and trapezoid *CDFE* then appear in the middle dial (—99760).

To find the double area of trapezoid *BDFG:*

1. On the keyboard place 90, which equals 50, distance of *G* from the refrence line, plue 40, distance of *F* from the reference line.

2. Run upper dial to elevation 100.

This last operation would give the area of trapezoid *BDFG*, but since the double areas of the two previous figures are already on the machine as minus quantities, the resultant figure appearing on the middle dial is the double area of *BEFG* (—0030).

Trapezoid *ABGH* is found in the same manner. Thus, on the middle dial of the calculator will appear the double area of the figure *ABEFGHA* (—0766).

This method is found especially rapid when two people work as a team, one reading and the other operating the calculator.

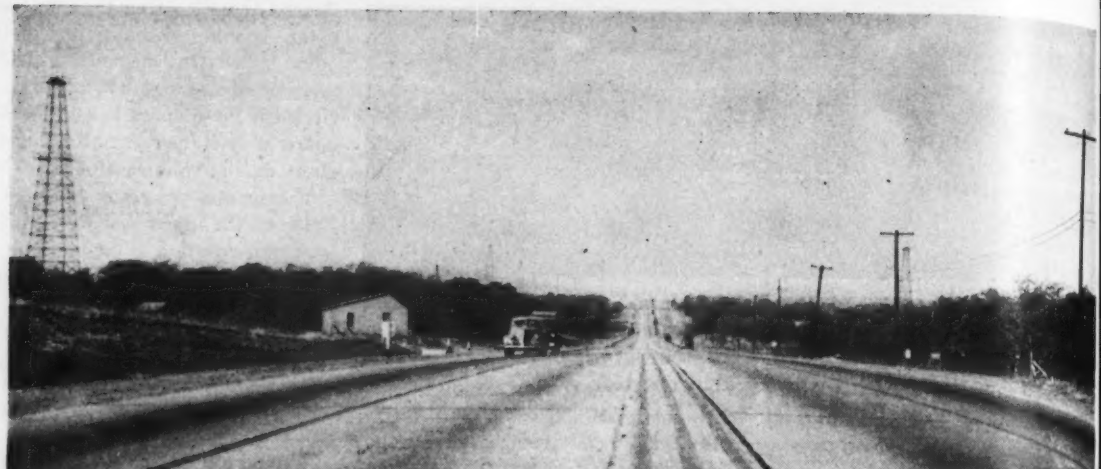


Fig. 1. Built on a tangent and with traffic divided, the new highway is expected to have a high hourly capacity.

Oklahoma Builds Divided Access Highway

***Contents in Brief**—An Oklahoma access road was constructed as two 22-ft. unreinforced roadways separated by a 3-ft. raised dividing strip. The center island was designed to devide traffic without being an impassable barrier in emergencies. Special study given to intersections*

MAJOR ROAD PROJECT completed in 1943 by the Oklahoma State Highway Department is a divided highway providing access to the Oklahoma City Army Air Depot and the Douglas Aircraft plant. The project starts at the eastern edge of the city and extends eastward 6.1 miles along S.E. 29th St. It is the longest divided highway ever built as one project in that state. The work is of added interest because of design features of the traffic intersections and the dividing strip.

Two 22-ft. roadways separated by a 4-ft. paved median strip are provided. The roadway slabs are of 9-6-9-in. cross section. Reinforcing consists of two ½-in. dia. longitudinal bars at each edge of both roadways and ½-in. dia. dowel bars on 2-ft. 6-in. centers along the longitudinal joint of each slab. Expansion joints are provided on 90-ft. centers and control joints on 30-ft. centers.

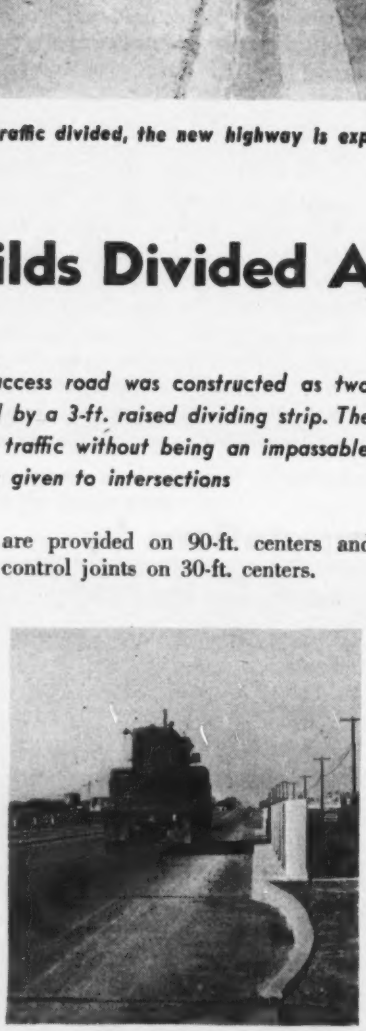


Fig. 2. The only bridge required has a roadway 3 ft. wider at each side than approach pavements.

The median strip was designed to divide traffic without being a barrier that could not be crossed in an emergency. To meet these requirements the strip was made 3 in. higher than the roadway slabs and of the shape shown by Fig. 4. Curb reflector markers were added on 25-ft. centers along both curbs of the barrier. To further aid motorists to distinguish the island, three 6-in. wide black stripes were added in the island.

New layout for intersection

In the attempt to obtain a better flow of traffic at the intersections, an intersection layout new to Oklahoma highways was introduced. It is illustrated by Fig. 3. Traffic on all four approach roads is separated by streamlined islands 100 ft. to 200 ft. long.

At the center of the intersection a diamond-shaped island with sides about 7 ft. long was constructed. A traffic light is to be added at the center of this island when materials become available.

ehicles turning to the left at the section use the inner lane and on the inner side of the island, h results in a smooth flow of traf- The proper path for motorists llow in turning is indicated by wide black traffic arrows as n by Fig. 3.

bservations made during the short the access road has been in serv- ndicate the intersection layout to atisfactory. It has permitted a l flow of traffic with little con- n.

Bridge built with wide deck

quired drainage structures in- d several box culverts and one orced-concrete girder structure. latter is a three-span, 35-49-35-ft. ing with a 54-ft. wide roadway, h places the curbs 3 ft. beyond outer edge of the approach pave- ts (Fig. 2). This extra width has en sufficient to prevent motorists turning toward the center of the when approaching the bridge, as might do if the deck were not wide.

he highway was built along a 120- right-of-way. Traffic on the old way had to be maintained much he time. To meet this require- , the contractor built one 22-ft. way and opened it to traffic be- the other was constructed. To er reduce the interruptions to c at intersections and several r points, considerable high-early gth concrete was used, which d be opened to traffic after 48 to ours.

he concrete median strip was laid wing completion of the pavement.

Construction requires one year

onstruction required the greater of a year, operations being shut n for many days because of slow rial deliveries and a long period eavy rainfall. When weather permitted, operations continued seven days a week from daylight to darkness. An average crew of about 100 men was used.

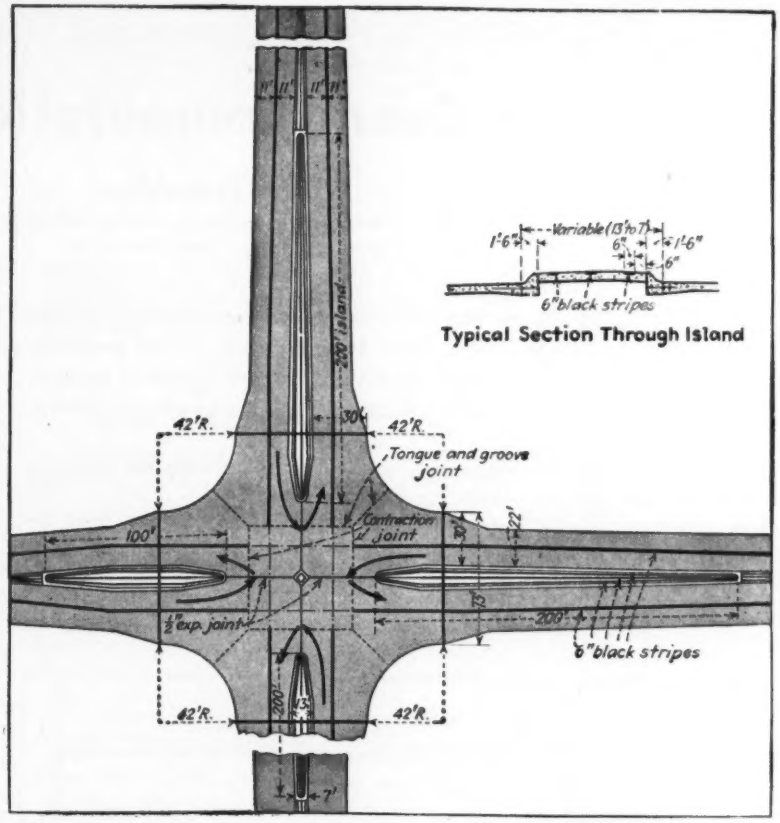


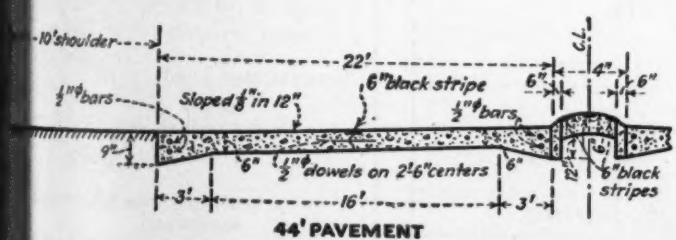
Fig. 3. For the intersections a layout of this type was introduced. Observations since the road was placed in service indicates the layout to be highly satisfactory.

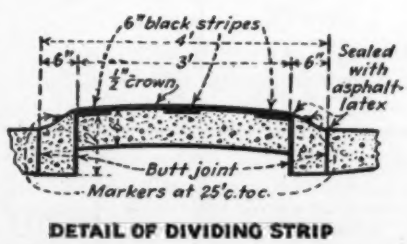
The contractor used one 34 E paver and one 27 E unit, both of the single-drum type. A concrete mix requiring 2,967 lb. of crushed stone, 1,691 lb. of sand, 670 lb. of cement and 5½ gal. of water for a 37-cu.ft. batch was specified.

Cost of the project, which required 134,000 cu.yd. of grading and 135,000 sq.yd. of plain concrete and 30,000 sq.yd. of high-early strength concrete, was $582,000. All funds were supplied by the federal government through the Public Roads Administration.

B. E. Clark is chief engineer of the Oklahoma department and John Stobaugh chief of construction. J. R. Keeth was resident engineer. For the PRA organization, W. V. Smiley is state engineer in Oklahoma and L. W. Roberts resident engineer at Oklahoma City.

Moran & Buckner, Muskogee, Okla., was the general contractor. For this firm L. R. Moran was in general charge and John K. Lyles superintendent on the early operations and Frank Fitch for the remainder of the program.





4. Two 22-ft. concrete roadways free of reinforcing steel except for two bars at both edges of each slab are pro- d. The dividing island was designed as a barrier that could be crossed in an emergency.

Continuous-Beam Computations Simplified

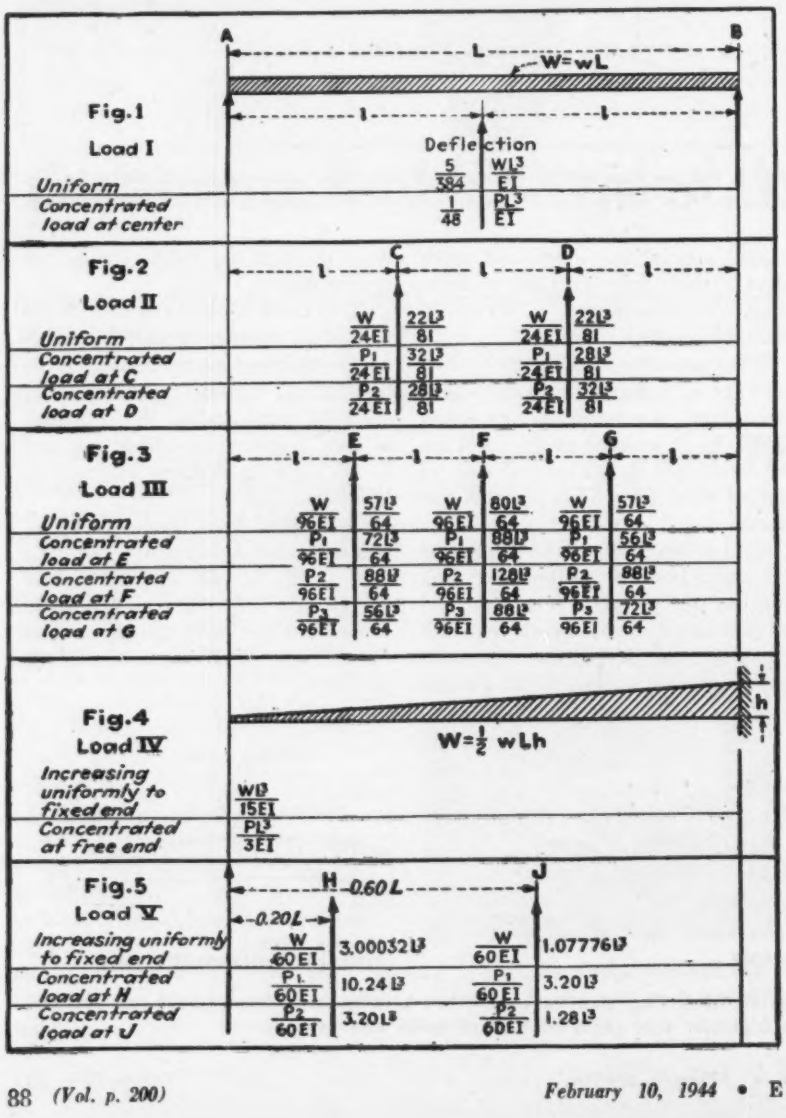
John T. Weldon
Field Engineer, Board of Harbor Commission, Milwaukee, Wis.

Contents in Brief—A method of solving continuous-beam problems whereby the computations involve linear equations only is made available. Analysis of typical beam loadings are carried out and a special application of the method to the design of a wood sheetpile dock wall is illustrated.

SOLUTION OF CONTINUOUS beams by the three-moment theorem always involves considerable labor, especially when the loading is not uniform or when the supports are not spaced uniformly or symmetrically. The following discussion offers a simple method of determining the moments and reactions.

This procedure has been used by the writer in the analysis of dock structures and he has found that it saves time and lessens liability of error, since the equations are all linear. The solution requires only a handbook showing the standard loading of a simple beam or for any loadings that may be divided into standard loadings. Seldom will it be necessary to resort to integration.

To explain the processes, five conditions of loading are shown by the accompanying diagram. Directly under the loading diagrams are shown the deflections due to the loadings. The computations follow in order.



Typical loading computations

A simple beam uniformly loaded is illustrated by Fig. 1. The deflections due to a uniform load and to a concentrated load at the center are recorded directly under the center of this beam. Equating the two deflections, the relationship becomes

$$\frac{1}{48}\frac{PL^3}{EI} = \frac{5}{384}\frac{WL^3}{EI} \text{ or } P = \frac{5W}{8} = \frac{5wL}{8} = \frac{5wl}{4}$$

It is obvious that the beam being uniformly loaded, the end reactions are identical and equal to

$$\frac{3W}{16} = \frac{3wL}{16} \text{ or } \frac{3wl}{8}$$

In Fig. 2 are recorded the deflections due to a uniform load and the deflections due to concentrated loads at the third points on the beam. The computations for these deflections follow. Uniform Loading:

$$D = \frac{Wx}{24EIL}(L^3 - 2Lx^2 + x^3)$$

Let $x = \frac{1}{3}L$

$$D = \frac{W\left(\frac{1}{3}L\right)}{24EIL}\left(L^3 - \frac{2L^3}{9} + \frac{L^3}{27}\right) = \frac{W}{24EI}\cdot\frac{22l^3}{81}$$

Concentrated Load:

$$D = \frac{Pbx}{6EIL}\left(2L(L-x) - b^2 - (L-x)^2\right) x < a$$

a = distance from left support to applied load.
b = distance from right support to applied load.
x = distance from left support to point of computed deflection.

Then when the load is at D, the deflection at that point is:

$$D = \frac{P\left(\frac{L}{3}\right)\left(\frac{2L}{3}\right)}{6EIL}\left(2L\left(\frac{L}{3}\right) - \frac{L^3}{9} - \frac{L^3}{9}\right) = \frac{P}{6EI} \cdot \frac{8L^3}{81} = \frac{P}{24EI} \cdot \frac{32L^3}{81}$$

When the load is at D, the deflection at C is:

$$D = \frac{P\left(\frac{L}{3}\right)\left(\frac{L}{3}\right)}{6EIL}\left(2L\frac{(2L)}{3} - \frac{L^3}{9} - \frac{4L^3}{9}\right) \frac{P}{6EI} \cdot \frac{7L^3}{81} = \frac{P}{24EI} \cdot \frac{28L^3}{81}$$

When the load is applied at C, the positions of the deflections as computed above would be reversed. The denominators of the fractions have been made identical so that the numerators will express the relationship between the different deflections.

It is at once apparent that P_1 is equal to $\frac{11W}{16}$ to produce the same deflections at Point C. It can also be seen that a load placed at D will produce a deflection which is $\frac{7}{8}$ of the deflection produced at C when the same load is placed at C.

Then $P_1 + \frac{7P_2}{8} = \frac{11W}{16}$

but $P_1 = P_3$

$\therefore \frac{15P_1}{8} = \frac{11W}{16}$

$P = \frac{11W}{30} = \frac{11wL}{30}$ or $\frac{11wl}{10}$

In Fig. 3, the same method of computation was followed and the deflections recorded as shown again, making the denominators identical.

At point E

$$P_1 + \frac{88P_2}{72} + \frac{56P_3}{72} = \frac{57W}{72}$$

At point F

$$\frac{88P_1}{128} + P_2 + \frac{88P_3}{128} = \frac{5W}{8}$$

Since the beam is symmetrical as to loading and support, P_1 is equal to P_3 and it is possible to write the equations:

$$\frac{128P_1}{72} + \frac{88P_2}{72} = \frac{57W}{72}$$

$$\frac{176P_1}{128} + P_2 = \frac{5W}{8}$$

Solving for P_1 and P_2,

$$P_1 = P_3 = \frac{2W}{7} = \frac{8wL}{28} = \frac{32wl}{28}$$

$$P_2 = \frac{13W}{56} = \frac{13wL}{56} = \frac{26wl}{28}$$

It should be noted that if the loading were not uniform or that the supports were not uniformly spaced, three linear equations would express the values of P_1, P_2 and P_3.

Some time can be saved by making use of the theorem of reciprocal deflections.

In a beam fixed at one end with a uniformly increasing load toward the fixed end, it can be seen from inspection of Fig. 4 that:

$$P = \frac{W}{5} = \frac{wLh}{10}$$

Special dock wall problem

Now that restrictions on critical materials makes procurement of steel sheetpiles improbable, the construction of dock walls has reverted to the old-time wooden structure tied back to an anchorage with tie rods and the wood sheetpiles supported at the intermediate points by one or more mudsills.

With this condition in mind Fig. 5 was prepared. In this work the assumptions were: (1) That the stress against the dock wall is based on equivalent fluid pressure, and (2) that the point of fixation in the mud is that point below the river bottom where, due to the passive earth pressure, the loading diagram crosses the line of the sheetpiles.

The point of application of the first support is at the tie rods, whose position is fixed within narrow limits by the variable decay of timber with respect to its position above or below water. The locations of the tie rods has been fixed arbitrarily at $0.20L$ and of the mudsill at $0.60L$.

With a uniform load increasing uniformly toward the fixed end:

Deflection at H equals

$$D = \frac{W}{60EIL^2}(x^5 - 5L^4x + 4L^5)$$

Let $x = 0.20$

$$D = \frac{W}{60EIL^2}(0.00032L^5 - L^5 + 4L^5) = \frac{W}{60EI}(3.00032L^5)$$

Deflection at J if $x = 0.60$ is

$$D = \frac{W}{60EIL^2}(0.07776L^5 - 3L^5 + 4L^5) = \frac{W}{60EI}(1.07776L^5)$$

Concentrated load:

Deflection under load is $D = \frac{P}{3EI}(1-a)^3$

Let $a = 0.20$, then

$$D = \frac{P}{3EI}(0.80)^3 = \frac{P}{3EI}(0.512) = \frac{P}{60EI}(10.24)$$

Let $a = 0.60$, then

$$D = \frac{P}{3EI}(0.40)^3 = \frac{P}{3EI}(0.064) = \frac{P}{60EI}(1.28)$$

Load at H, deflection at J:

$$D = \frac{P}{6EI}(-3aL^2 + 2L^3 + x^3 - 3ax^2 - 3L^2x + 6aLx) \quad x > a$$

Let $x = 0.60L$ and $a = 0.20L$, then

$$D = \frac{P}{6EI}(-0.60L^3 + 2L^3 + 0.216L^3 - 0.216L^3 - 1.8L^3 + 0.72L^3) = \frac{P}{6EI}(0.32L^3) = \frac{P}{60EI} \cdot (3.2L^3)$$

By the theorem of reciprocal deflection, when the load is at J, the deflection at H is also

$$\frac{P}{60EI}(3.2L^3)$$

Then

$$P_1 + \frac{3.2P_2}{10.24} = \frac{3.00032W}{10.24}$$

$$\frac{3.2P_1}{1.28} + P_2 = \frac{1.07776W}{1.28}$$

Solving

$$P_1 = 0.13657W = 0.06829wLh$$

$$P_2 = 0.50057W = 0.25029wLh$$

There is a slight error due to neglecting the small triangular loading of the passive earth pressure, but the error is on the side of safety. As the deflection at any point is directly proportional to the value of any concentrated load, it is possible to use this method to obtain the reactions and moments at yielding supports. However, the numerical value of the deflection must be computed at the support, as well as the amount of the settlement.

Georgia Road Upkeep Cost At Peak in 1943

During 1943 the Georgia Highway Department spent $3,809,343.09 for maintenance on state roads and bridges—an increase of $1,781,838.64 over the previous year, State Highway Director Ryburn G. Clay reported Jan. 10.

"This is the largest amount provided for maintenance in any one year in the history of the department," Mr. Clay stated.

He said $1,628,358.53 was spent for routine maintenance on the state's 13,992 miles of highways. In addition, he declared, $2,180,984.56 was provided for resurfacing of the bituminous paved roads and for repair of the state's approximately 2,400 wooden bridges.

Seattle Rids Pavements of Steel Rails

***Contents in Brief**—Various methods of rail removal and repaving were employed in removing rail skid hazard. Rails 35 yr. old broke easily, presumably from crystallization. Repaving costs had to be kept low. Rail removal has the effect of adding one or more lanes to traffic capacity of streets.*

OUT IN THE NORTHWEST a large city is completing the removal of "improvements" that took many years to build and cost millions of dollars. Seattle is rapidly removing from all city streets the rails in tracks that have been unused since electric street railway operation was discontinued some three years ago. At the start of the work there was about 25,000 long tons of steel in 106 mi. of double track (424 mi. of rail); about 90 percent of this rail tonnage had been removed as this was written. On most of this work the matter of safety and traffic capacity of the streets outweighed salvage incentive.

Fig. 1. Ripping out rails with tongs on a power shovel boom. Outside pavement was held down by the shovel treads.

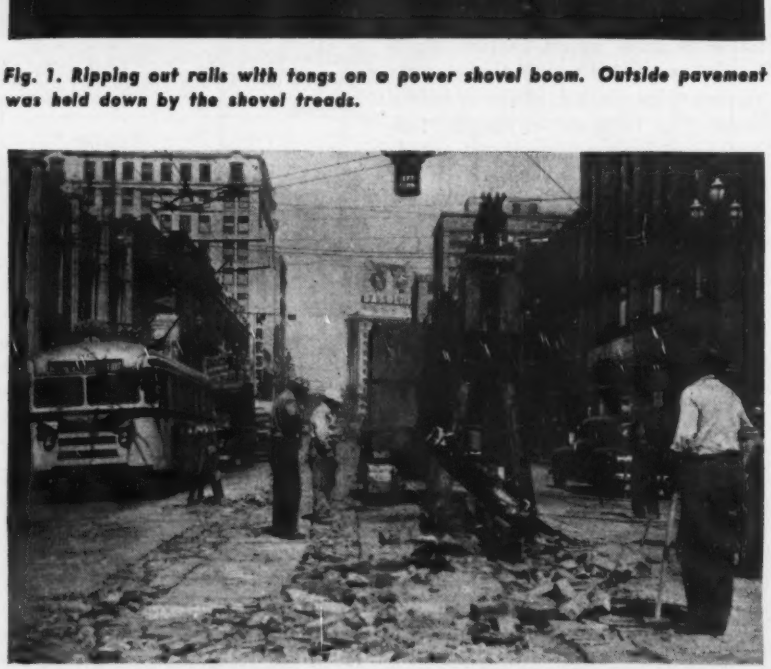


Fig. 2. More effective method used was an A-frame and a six-part tackle for removing the rails.

Shortly after rail transportation was discontinued the Seattle Transportation Commission removed about 8,000 long tons of 4½-in., 60-lb. "T" rail from 40 mi. of double track, 28 mi. of which had never been paved and 12 mi. of which had been surfaced with removable concrete slabs. This steel, which the commission sold on the open market, included all of the rails that were suitable for relaying.

The remaining 17,000 long tons of steel embedded in some 60 mi. of pavements was mostly of the high "T" or Shanghai section, weighing 80 lb. per yard. There also were several miles of 7-in. girder section, weighing 112 to 127 lb. This steel was considered to have value only as scrap. All of this trackage was on wood ties embedded in concrete with 6 in. of concrete under the ties. The 60 mi. of double track was all in brick, stone or asphalt pavement with roadways on the side paved with brick, stone, asphalt or concrete. In no case were the concrete base and ties removed.

Low salvage recovery

During 1941 and 1942 the city removed about 6,000 tons of steel from 20 mi. of streets, selling the scrap on the open market for about $14 per ton. The cost of removal and pavement repairs varied from $70 per ton where the street railway section was surfaced with 3½ in. of asphalt and was repaired in like manner, to $110 per ton where the track section was paved with brick or stone and the resurfacing was done with "1.25" concrete (5 sacks of cement per cu. yd.) for a width of 18 ft. averaging 6½ in. thick.

In 1942, when metal salvage came

the national limelight, about 40 of the double-track lines re- ned to be removed and arrange- ts were made between federal Seattle city authorities whereby he remaining rails would be taken

n this 40 mi. double track there about 11,000 tons of rail or 275 per mile of double track (in- ling bolts and plates). Under the tractual arrangements, about 8,- tons of this was to be taken out ederal expense and some 3,000 by the city. On the 30 mi. re- ed under federal contract the sold the steel scrap to the gov- ment for $1 provided the govern- t paid all costs of removing the and restoring the pavement sur- . The government, in turn, rded a contract for this entire i. job, which was about 60 per- complete as this is written. The cost to the government under plan is estimated at about $60 long ton of rail removed.

n the remaining 10 mi. removed the city, the government agreed ay the city $46.50 per ton for the p metal. This salvaged metal was by the government to local steel for about $16.50 per long ton. he streets from which steel was oved by the city were those with ern concrete side roadways. The ir of the 18-ft. center strip, from h the rails were taken, was made "1.25" concrete at a cost of t $110 per ton of steel removed. ddition to the patriotic recovery crap, the city had a safety objec- in removing the traffic menace of ding on wet rails which is serious city where streets are often wet. he gain in traffic capacity ex- ed expectations for reasons made rent by the sketches in Fig. 4. conscious of the skid menace wet rails, a driver will always

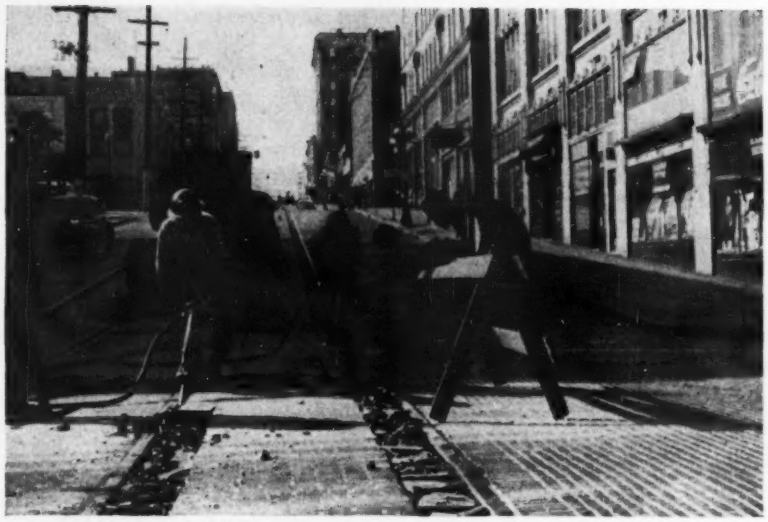


Fig. 3. Still another method of rail removal first takes out pavement and spikes along one side of the rail, which is then slid sidewise.

straddle a line of rails when he can. If he straddles one of the inner rail limes the clearance is insufficient for safely passing a car similarly straddling the inner rail on the other track. Hence, drivers prefer to straddle the outer rail of a double-track line. This wastes roadway width.

After the rails were removed and the paving was restored, the two center lines of traffic automatically moved enough closer together to make width for an additional lane. Thus, in addition to safer operation, by doing away with the skid menace, an actual increase of 40 percent in traffic capacity was realized by the rail removal program. This gain in effective width was so noticeable to drivers accustomed to using certain streets, that many stated their belief that the curbs had been set back in an actual widening operation.

Methods of rail removal

The government contractor, left to his own devices as to methods of removal so long as all disturbed pavement was restored, on Western Ave., took out the full width of pavement between each pair of rails. This involved handling more material but enabled him to finish quicker and for less labor cost.

On other jobs he used pneumatic gads to break out a strip of pavement along the inner face of the rail, pulled the spikes on that side and then slid the rail sideways into this space. In this operation the rails came away from spikes on the opposite side with surprising ease and there was a minimum disturbance of the good, serviceable pavement.

On the greater portion of the work done by the government contractor, however (including all of the asphalt sections), rails were pulled by a power shovel on which two pairs of tongs had been attached to the boom, after removing the dipper. The heavier lifting operation was done by a pair of tongs close to the shovel, using the shovel tread to hold the pavement down. The handling

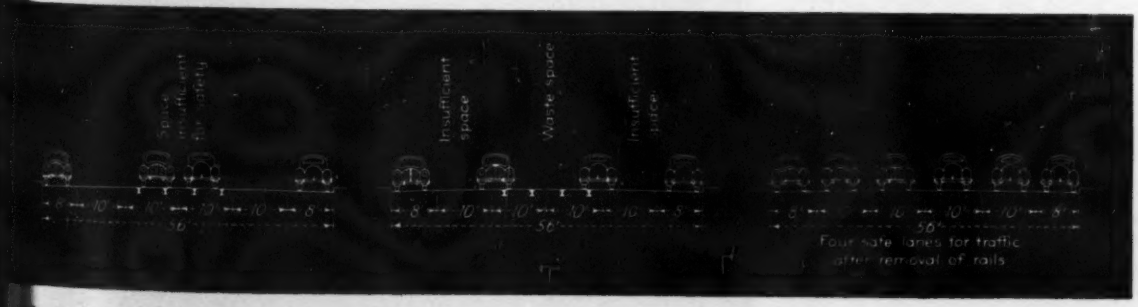


Fig. 4. Sketch indicating how street width was wasted when drivers straddled a line of rails to avoid the skid menace.

of the rails was done by a lighter pair of tongs nearer the end of the boom.

All of the city's work was done by this quicker and less expensive method; namely, ripping out the rails with a power shovel and without previous expenditure of labor on the pavement. After some experience, the shovel was aided by a heavy structural steel A-frame to which was attached a six-part tackle. In this way less pavement damage was done as the A-frame aided in holding the pavement down while the rails were lifted by a pair of tongs attached to the lower block of the tackle. This method required the removal of the surface from the entire street railway section of the street but there was enough saving in labor cost (as compared to the slower hand method) to more than offset the cost of repaving the larger area.

In all pulling operations by contractors on both city and government jobs, the rails were cut with an oxy-acetylene torch at 30-ft. intervals, or at shorter intervals on the curves. The cut was made only through the head of the rail, but when the rail was pulled to a length of 30 or 40 ft. and then lowered suddenly, it invariably broke at the point where the head had been cut. In many instances breaks also occurred at intermediate points.

Further indications of a surprising brittleness of the metal appeared when the tongs on the power shovel, hooked under the ball of the rail, pulled the ball off instead of lifting out the rail. Fractured surfaces had a decidedly granular appearance and it is current opinion that the ease with which breaks were made resulted from crystallization caused by the long continued vibration and hammering of steel wheels. Very little of the girder rail had been down less than 25 yr. and the average service period had been about 35 yr.

Repaving Methods

Most of the trackage removed by the transportation commission had been laid without paving or was surfaced with precast concrete slabs. The greater part of this had 6 in. of well compacted base material beneath the ties. After removal of rails and ties this base was worked over, on about 20-mi. of double track line, and to it was added a 3½-in. depth of new material thoroughly rolled with a 10-ton roller and finally covered over with a one-course, 2½-in. asphaltic surface. This topping consisted of pit run sand and gravel of maximum ¾-in. size, weighing 140 lb. per cu.ft., to which 5 percent by weight of grade D asphalt was added in a plant mix.

This treatment, costing only about 45c. per sq.yd., was used by reason of necessity at a time when the city did not have funds for a more substantial surfacing. However, it has given satisfactory service, perhaps partly because of the concrete pavement on both sides of such open trackage. The 18 or 20 mi. of this 2½-in. topping on rolled fill in the 18-ft. center strip is all in good shape after periods of service ranging up to three years.

As to the 60 mi. of streets with embedded rails, the following repaving procedure has been followed:

On streets with modern concrete side roadways, the surface was removed from the entire street railway section and the repaving was done with concrete.

On streets with asphalt side roadways, the entire surface was removed from the street railway section and the repaving was done with an asphalt mix.

On streets with brick or stone roadways, various schemes have been followed: Removing the surface from the entire 18-ft. width, removing the surface between each pair of rails, or excavating a narrow slot along the inside of each rail by means of a jackhammer. In all cases the repaving has been with concrete, and it is intended eventually to resurface all such roadways with 2 in. of asphaltic concrete.

The city's work under the federal agreement has been completed and when the government contractor has completed his contract there will remain only about 6 mi. of double track in Seattle's streets. Four miles of this was covered with asphaltic concrete before the steel shortage was foreseen, and about two miles is in monolithic concrete pavement.

It is proposed to attempt to remove the ball or head from the rails in monolithic pavement by cutting with a torch, working from the flangeway side of the rail, and then filling with asphaltic concrete the groove thus left in the pavement. This method, however, had not yet been tried as this was written.

The entire rail removal project, including federal negotiations as well as direction of the contracted work, has been carried out under supervision of C. L. Wartelle, Seattle city engineer.

Wood Block Paving 31 Years After

The last of Seattle's wood block pavement, which has been in service for 31 yr. and is now scheduled for early removal, is shown in this picture taken at a point where the rows of blocks, at street center, have been thrust 3 ft. out of line, presumably as the result of braking effect in motor vehicles moving down the grade of about 2 percent. The blocks are creosoted Douglas fir and ½-in. creosoted strips separate successive rows. Despite this considerable movement and the long period of service, no damage to the wood blocks was to be noted.

Gravel and Stone in Comparable Mixes

W. S. Elliott
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***Contents in Brief**—Gravel and crushed stone coarse aggregates, representative of those available around New York City, were used recently in concrete test specimens made of the respective aggregates to determine their relative compressive strengths. Differing cement contents were used in several mixes for each aggregate, proportioned to provide, in so far as possible, the same apparent workability. The stone and the gravel producers associations cooperated with engineers of New York City's Department of Public Works in the tests and interpretation of the results.*

DOLOMITIC LIMESTONE and quartz gravel are representative of coarse aggregates economically available to the City of New York. As a result of discussions of the relative compressive strengths obtainable from concrete made with these two materials under comparable conditions, it was decided to conduct a series of laboratory tests. The tests were sponsored by the Department of Public Works of New York City, assisted by engineers of the office of the President of the Borough of Queens. They were conducted in cooperation with the National Crushed Stone Association and the National Sand and Gravel Association.

Two series of tests were made involving the manufacture and testing in compression of 216 standard 6x12-in. concrete cylinders. Test specimens were made for each of the two coarse aggregates containing 4, 5, 6 and 7 bags of cement per cu. yd. The aim was to maintain the consistency of the concrete to that represented by a standard slump of 4 to 5 inches.

The proportions of fine to coarse aggregates were calculated in accordance with the procedure outlined in Bulletin 11 of the National Crushed Stone Association, "A Method for Proportioning Concrete for Compressive Strength, Durability and Workability," by A. T. Goldbeck and J. E. Gray. The method provides for the use of a constant volume of dry-rodded coarse aggregate per unit of volume of concrete, irrespective of the cement content or of the type of coarse aggregate. The quantity of coarse aggregate depends upon its maximum size and upon the grading of the fine aggregate. Proportions calculated by this procedure were checked by other methods by Stanton Walker, director of engineering of the National Sand and Gravel Association and agreed to by him. Source of aggregates and data on physical characteristics of both the fine and coarse aggregates are given in Table 1. Coarse aggregates were separated into different sizes and recombined to approximately the same gradings.

TABLE 1—PHYSICAL CHARACTERISTICS OF AGGREGATES

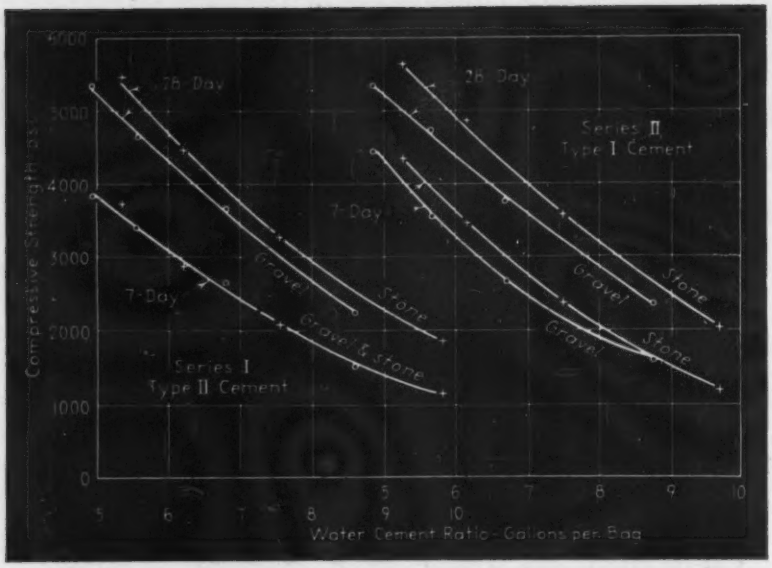
Crushed stone is dolomitic limestone from Tompkins Cove Quarry of the New York Trap Rock Corporation.
Gravel is quartz gravel from Oyster Bay, Long Island, N. Y., produced by Gallagher Bros. Sand and Gravel Corp.
Sand for Series I from Port Washington Plant of Metropolitan Sand and Gravel Corporation and for Series II from Oyster Bay, produced by Gallagher Bros. Sand and Gravel Corp.

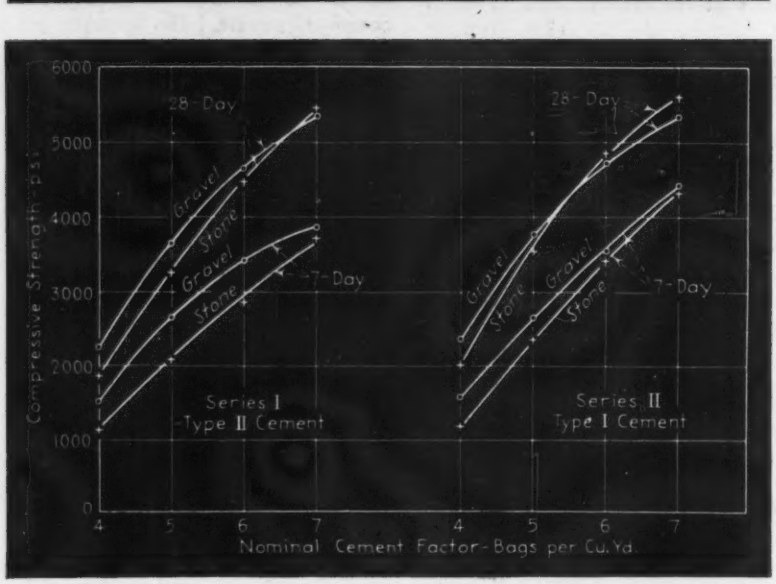
Item	Physical Characteristics Series I			Series II		
	Stone	Gravel	Sand	Stone	Gravel	Sand
Sieve Analysis, percents retained on						
No. 100	....	....	96	....	....	97
No. 50	....	....	81	....	....	83
No. 30	....	....	38	....	....	45
No. 16	....	....	18	....	....	25
No. 8	....	....	7	100	100	12
No. 4	100	97	1	97	97	5
⅜ in.	75	75	....	75	75	0
½ in.	....	....	....	67	....	....
¾ in.	27	27	....	30	30	....
1 in.	0	0	....	0	0	....
Fineness Modulus	7.02	6.99	2.41	7.02	7.02	2.67
Miscellaneous Characteristics						
Specific Gravity (Bulk)	2.81	2.63	2.63	2.81	2.61	2.63
Absorption (24-hr.)	0.5	0.6	0.5	0.5	0.5	0.4
Lb. per cu. ft. in.						
Solid	175.3	164.1	164.1	175.3	162.9	164.1
Dry-rodded	104.0	107.7	103.8	106.6	108.8	....

Test procedure

It was desired to make the tests with a cement that might give reasonably conservative values. With that purpose in mind a Type II portland cement was used in Series I. The sand made available for the Series I tests was quite finely graded as may be seen from Table 1. It was felt that the results obtained with the Type II cement might not be entirely typical of concrete used in building construction and, therefore, a Type I cement and a coarser sand were used for a second series of tests.

In each series, specimens were molded for the four different cement contents (4, 5, 6 and 7 bags per cu. yd. of concrete) on one day and the work repeated on two succeeding days. In Series I, five specimens were made from each batch, two of which were tested at 7 days and three at 28 days, making either six or nine specimens available for each condition of test. In Series II, four specimens were made from each batch, two





Comparable strengths of stone and gravel concrete. Fig. 1 (top) shows relation of water-cement ratio to strength of concrete made with each material. Fig. 2 (below) shows strength with the same cement factor. Curves are plotted on the basis of the adjusted averages of test specimens shown in Table 2.

being tested at 7 days and two at 28 days, resulting in six specimens for each condition of test.

All aggregates were in approximately a saturated-surface-dry condition when incorporated in the concrete, which was mixed by hand with shovels in a water-tight pan. In Series I the batches were about 1.20 cu. ft. and in Series II about 0.9 cu. ft. The sand and cement were mixed first; the coarse aggregate was then added and all solid ingredients thoroughly mixed. Most of the estimated mixing water was then added and the concrete mixed; mixing was continued and the remainder of the mixing water added gradually until judgment indicated that the desired slump of 4 to 5 in. had been attained.

The cylinders were molded, by standard A.S.T.M. procedure, in 6x12-in. paraffin coated cardboard cylinder molds. After 24 hr. the cardboard forms were removed and the concrete cylinders stored in a moist room maintained at approximately 70 F. until tested. The cylinders of Series I and the 7-day cylinders of Series II were capped, top and bottom, with a sulphur compound. Difficulties with warped caps resulted and all remaining cylinders were capped with high-early-strength neat cement paste.

All specimens for Series I and the 7-day specimens for Series II were tested in one of two lever-type screw testing machines. With minor exceptions, those specimens requiring a total load of less than 100,000 lb. were tested in the 100,000-lb. capacity testing machine of the Borough of Queens. The stronger specimens (total load over 100,000 lb.) were tested in the 400,000-lb. capacity testing machine of the Borough of Queens. Erratic results were obtained on the 400,000-lb. machine as a result of which the 28-day specimens of Series II were tested in the 200,000-lb. capacity hydraulic testing machine of the Borough of Bronx.

Test results

Tables 2 and 3 summarize the results of the concrete tests. Table 2 shows the strengths of each cylinder. It will be observed that two averages are shown—an "average" and an "adjusted average." The "adjusted average" represents an endeavor to minimize the effects of erratic results referred to previously. It consists of the averages of the highest testing two-thirds of the specimens in each group; that is, the lowest testing one-third of the specimens in each group were discarded. This procedure was followed, instead of more commonly applied rules for discarding erratic results, because it was felt that the particular errors of testing encountered in this work would practically always lead to results too low and practically never to results too high. In any event, all groups of specimens were treated alike in securing the adjusted average. Table 3 shows average values for compressive strength, cement factor, water-ratio, slump, weight of concrete per cu. ft., and quantities required per cu. yd.

Fig. 1 shows water-ratio strength relations for the two Series. Except for the 7-day tests of Series I, the water-ratio strength curve for the crushed stone concrete is somewhat higher than for the gravel concrete. It is worthy of note that the differences between the two curves are greater in Series II than in Series I. A principal difference between these two series, it will be recalled, was that Type II cement and a finely graded sand were used in Series I, while Type I cement and a more

coarsely graded sand were used in Series II. Also there were the differences in capping and testing procedure referred to earlier.

Fig. 2 summarizes the cement content strength relations found. Here again the effect of some differences in materials or procedure as between Series I and II is evidenced. In Series I the gravel concrete was generally higher in strength, for a given cement content, than the stone concrete—these differences being most evident in the leaner mixes and practically disappearing in the 7-sack mixes. In Series II, the gravel concrete strengths were somewhat higher than the stone concrete strengths for the 7-day tests and for the 4 and 5-bag mixes of the 28-day tests. The 6 and 7-bag concrete, in the 28-day tests, showed somewhat higher strengths for the stone concrete than for the gravel concrete.

Further study needed

These data are presented as a matter of general interest and as of particular interest to engineers and producers in New York City. It should be emphasized that there is no thought in the mind of the author that they are indicative of results to be obtained with all gravels and all crushed stones or with different combinations of these materials. They are represented to show no more than what was obtained for the conditions of these tests.

The apparent effect of type of cement, grading of sand, and some other factor in these tests on the comparative results deserves further investigation.

TABLE 2—DATA FROM STRENGTH TESTS

Summary of test results of individual cylinders. Adjusted average is average of the highest two-thirds of results in each group. Complete tabulation of breaking strengths of individual cylinders is shown for a 6-bag batch as typical.

Cement bags per cu. yd. of concrete (Nominal)		Compressive Strength, p.s.i.							
		Series I				Series II			
		Stone		Gravel		Stone		Gravel	
		7d.	28d.	7d.	28d.	7d.	28d.	7d.	28d.
4	Average	1094	1762	1470	2143	1158	2004	1539	2322
	Adjusted Av.	1115	1846	1505	2217	1202	2018	1600	2357
5	Average	2029	3144	2574	3333	2307	3533	2625	3706
	Adjusted Av.	2068	3246	2630	3643	2371	3588	2656	3763
		2716	3976	3437	3580	3281	4399	3701	3926
		2805	4261	3531	4358	2895	4910	2984	4499
		....	3860	....	4316	....	....	....	....
		2927	3805	2936	4693	3400	4951	3380	4936
		2402	4586	2684	4162	3600	4696	3500	4735
		....	4719	....	4821	....	....	....	....
		2964	4393	3674	4679	3465	4823	3722	4569
		2790	4479	2895	4590	3405	4774	3099	4640
		....	4424	....	4684	....	....	....	....
6	Average	2767	4258	3193	4431	3341	4759	3398	4551
	Adjusted Av.	2872	4477	3394	4638	3468	4864	3576	4720
7	Average	3651	5231	3584	4904	4251	5430	4171	5229
	Adjusted Av.	3701	5469	3836	5354	4345	5646	4424	5358

TABLE 3—SUMMARY OF CONCRETE DATA

Each value is average of data for the three rounds of test specimens. Note that the strength values are the *adjusted averages* referred to in Table 2.

Cement bags per cu. yd. of Concrete		Pounds of Dry Aggregate per cu. yd. of Concrete		Weight of Concrete lb. per cu. ft.	Slump in.	Water gal. per sack	Adjusted Average Compressive Strength, psi.	
Nominal	Measured	Sand	Coarse Aggregate				7d.	28d.
				Series I — Stone				
4	3.95	1375	2005	150.9	3½	9.82	1115	1846
5	4.98	1315	2010	152.4	4½	7.54	2068	3246
6	5.96	1255	2010	153.2	4½	6.20	2872	4477
7	6.91	1185	2010	153.9	4½	5.35	3701	5469
				Series I — Gravel				
4	3.93	1250	2060	147.2	3½	8.60	1505	2217
5	4.98	1180	2080	148.8	4½	6.81	2630	3643
6	5.95	1115	2080	149.5	4½	5.57	3394	4638
7	6.96	1040	2090	150.9	5	4.96	3836	5354
				Series II — Stone				
4	3.96	1395	1975	150.5	3½	9.68	1202	2018
5	4.95	1340	1970	151.0	5	7.50	2371	3588
6	5.96	1260	1980	152.1	4	6.15	3468	4864
7	6.97	1195	1985	153.3	4½	5.27	4345	5646
				Series II — Gravel				
4	3.97	1290	2020	147.3	4½	8.77	1600	2357
5	4.96	1245	2020	148.4	4½	6.70	2656	3763
6	5.97	1155	2030	148.9	4½	5.67	3576	4720
7	6.93	1075	2020	149.1	4½	4.85	4423	5358

COMMENT ON TESTS

A. T. Goldbeck
Engineering Director
National Crushed Stone Association

Bulletin No. 11 of the National Crushed Stone Association, "A Method for Proportioning Concrete for Compressive Strength, Durability and Workability" (For a short article on the method see *ENR* Nov. 5, 1942, p. 638) is based on tests which indicated that "different coarse aggregates of the same size will produce only immaterial variation in strength when the same cement factor and consistency are used." The present tests were really made to determine the validity of that statement as applied to New York aggregates.

Concrete as placed in construction is subject to many variables not present in laboratory concrete; hence, it is always advisable to assume that relatively low strength values may be obtained on the job, lower than would be obtained under ideal laboratory conditions. For design purposes, therefore, relatively conservative strength values for given cement factors should be assumed as has been done in Table II of Bulletin 11.

Apparently the method of design using the same cement factor and the same slump irrespective of the coarse aggregate gives safe results as applied to New York aggregates.

It will be interesting to compare the differences in strengths between the stone and gravel—first, using the same water-cement ratio, and second, using the same cement factor. This comparison is shown in Table 5. Column 4 shows the additional strength of stone over gravel concrete when both have the same water-cement ratio, and Column 7 shows how much stone is penalized in ce-

TABLE 4—Comparison of the strengths required for design purposes interpolated from Bulletin 11 of the N.C.S.A. and the actual 28-day laboratory test results.

Nominal Cement Factor	Strengths Required for Design Purposes (See NCSA Bulletin 11)	28-Day Strengths			
		Series I Type II Cement		Series II Type I Cement	
		Gravel	Stone	Gravel	Stone
(A)	(B)	(C)	(D)	(E)	(F)
4	1400	2217	1846	2357	2018
5	2600	3643	3246	3763	3588
6	3700	4638	4477	4720	4864
7	4600	5354	5469	5358	5646

TABLE 5—Comparison of difference in strengths between stone and gravel for the same water cement ratio and for the same cement factor.

1	2	3	4	5	6	7	8 and 9
	Compressive Strength, 28-day for Same W/C			Cement Factor			Difference in Strength for Same Cement Factor
W/C ratio Gal. per Sack	Gravel	Stone	Difference (3) — (2)	Gravel	Stone	Difference (6) — (5)	
Series I — Type II Cement							
5	5300	5800	+500	6.95	7.5	.55	7 Sacks +115*
6	4300	4700	+400	5.6	6.2	.6	6 " −161
7	3450	3750	+300	4.85	5.35	.5	5 " −400
8	2700	2950	+250	4.3	4.75	.45	4 " −371
9	2000	2300	+300	3.85	4.10	.25	
Series II — Type I Cement							
5	5200	5900	+700	6.75	7.45	.70	7 Sacks +288†
6	4400	4900	+500	5.6	6.1	.50	6 " +144
7	3600	4000	+400	4.85	5.30	.45	5 " −175
8	2900	3250	+350	4.35	4.75	.40	4 " −339
9	2200	2500	+300	3.9	4.25	.35	

+ indicates stone exceeds gravel. * Values are differences between Col. C and Col. D of Table 4.
† Differences, Col. E and F.

ment factor when the same W/C is used for stone and gravel mixes.

When values in Col. 9 are compared with Col. 4 it is seen that the differences in strength between the stone and gravel concretes, in the majority of cases, were less when both had the same cement factor than when both had the same water-cement ratio.

Concretes made with these respective coarse aggregates for practical purposes will have the same compressive strength when they have the same cement factor.

Sanitation Program in Brazil Broadened Under New U.S. Agreement

Health and sanitation work in the Amazon and Rio Doce valleys of Brazil, which are being developed as sources of strategic materials, will be extended under a five-year agreement recently made between Brazil and United States. The new agreement, which broadens the scope of the cooperative work begun by these countries in 1942, calls for a joint fund of $8,000,000 to carry on projects supporting economic and industrial development. The Amazon region is the source of rubber and other forest products, while the Rio Doce valley is one of the world's greatest sources of minerals, including huge iron ore deposits. (See *ENR*, Dec. 30, 1943, p. 954). These areas are supplying essential materials for United Nations.

Brazil has agreed to contribute $5,000,000 to the joint fund for continuation of the work over a five-year period. The United States contributes $3,000,000, through the Institute of Inter-American Affairs, an agency of the Office of the Coordinator of Inter-American Affairs.

These funds will enable the organization built up in the last two years to carry on numerous sanitation projects. Railroad centers, airports, river shipping points and other strategic areas are expected to benefit from malaria control and other sanitation measures to curb the spread of disease. Serving as the crossroad for heavy wartime air traffic to and from Africa and other trans-Atlantic destinations, northern Brazil has special need for additional health facilities.

About five United States engineers, doctors and other specialists are working with 2,500 Brazilians on this program. In the Amazon the job includes the distribution of anti-malarial medicines from infirmaries, medical posts and dispensaries. Other phases of the Amazon work include the establishment of mosquito control posts at main points of supply and drainage of malaria swamps around large communities.

In the Rio Doce area the projects embrace construction of water supply and sewage systems, installation of drainage ditches and other sanitation facilities.

Loans Aid Construction In Latin America

Roads, steel mills, hydro-electric plant and other permanent additions to the productive facilities of Latin America are being built with the aid of credits from the U. S. Export-Import Bank. Loans made by the bank to aid in this development of hemisphere productive facilities and for expansion of Inter-American trade now amount to $212,000,000, according to figures recently made public by Warren Lee Pierson, president of the bank. Of this total, approximately $107,000,000 has been repaid. No loans are in default.

Since it was created in 1934, Mr. Pierson disclosed, the bank has authorized lines of credit aggregating $779,000,000 for operations in the other American republics. Of this amount, however, more than $200,000,000 has been canceled or expired. A substantial part of these credits were made by the Export-Import Bank to aid in development of hemisphere resources under the program of the Rio de Janeiro conference of American foreign ministers in January 1942.

Highway development is illustrated by the extension of $30,000,000 in credits to Mexico for its big road-building program, of which $10,000,000 has been used. Expansion of hemisphere steel-making facilities with the aid of Export-Import Bank credits centers mainly in Brazil's great Volta Redonda plant, now building for completion in 1944-45. Some $45,000,000 in credits have been made available for purchase of equipment and materials in the United States.

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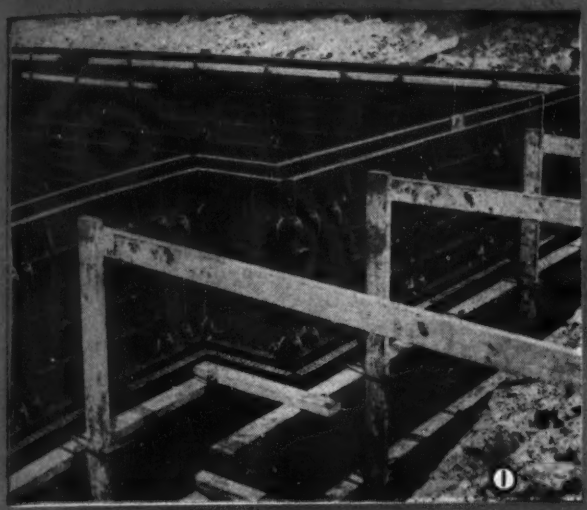

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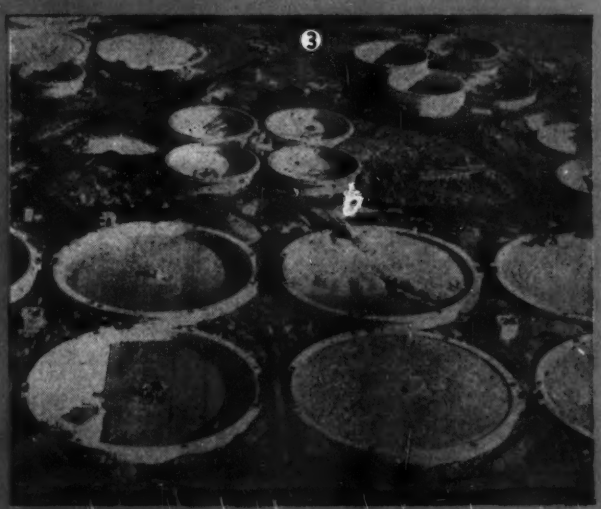

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CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

HIGHWAY BRIDGE, FLORIDA

OWNER: State Road Dept. of Florida, Tallahassee, J. H. Dowling, state hwy. engineer.

PROJECT: Construction of concrete and steel highway lift bridge over West Bay Creek in Bay County, Florida. Length of project 704 ft. Involves necessary clearing and grubbing; removal of existing structure; concrete for substructure, superstructure and counterweight; reinforcing steel and structural steel; machinery, castings, wire rope and wire rope attachments, and counterweight sheaves; timber and concrete piling; steel bridge floor; control house, gasoline power unit, and operator's house.

CONDITIONS: Contractor to furnish all materials and complete work in 250 working days. Rail, highway and water transportation facilities available. Prevailing wage rates to be paid.

BIDS: Five bids were opened January 18, 1944, ranging from the contract low of $250,739 to $274,305.

LIST OF BIDDERS:

1. Cleary Bros. Constr. Co., West Palm Beach, Fla. (contract) $250,739
2. C. C. Moore Constr. Co., Inc., Panama City, Fla 266,552
3. L. J. & W. L. Cobb, Inc., Tampa, Fla 268,988
4. Royce Kershaw & Co., Panama City, Fla 274,162
5. Coggin & Deermont, Chipley, Fla 274,305

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Clearing and grubbing	1.616 ac.	$150.00	$200.00	$250.00
2. Removal of exist. structure	Lump Sum	5,800.00	4,000.00	3,300.00
3. Treated struct. timber (12# trtmt.)	21.5 Mbm.	248.00	200.00	300.00
4. Concrete, Class A-A, substruct.	380 c. y.	54.00	47.00	49.95
5. Conc., Class A-A, superstruct.	831.2 c. y.	43.00	42.00	49.95
6. Conc., Cl. A-A, counter weight	54.4 c. y.	54.00	35.00	48.82
7. Concrete handrail	1,189 l. f.	2.50	4.00	2.50
8. Reinforcing steel	233,260 lb.	.07	.055	.055
9. Structural steel	267,300 lb.	.147	.18	.165
10. Machinery and castings	Lump Sum	16,991.60	20,084.40	18,410.70
11. Wire rope and wire rope attachmts	5,700 lb.	.58	.70	.638
12. Counterweight sheaves	Lump Sum	6,148.00	7,377.60	6,762.80
13. Treated timber piling (22#)	5,400 l. f.	2.25	2.10	2.45
14. Precast conc. piling (18-in. sq.)	10,000 l. f.	6.40	7.50	7.45
15. Unloaded test piling (18-in. sq. conc.)	180 l.f.	15.00	10.00	16.00
16. Waterproofing	3,251.3 s. y.	.75	1.00	1.50
17. Steel bridge floor	2,546 s. f.	1.53	2.00	1.90
18. Control house	Lump Sum	1,525.00	2,500.00	800.00
19. Gasoline power unit	Lump Sum	2,600.00	3,120.00	2,860.00
20. Operator's house	Lump Sum	5,817.40	4,000.00	3,250.00

SEWERAGE SYSTEM, SENECA, ILL.

OWNER: Federal Works Agency, Chicago; McCoy & Mulford, Chicago Heights, engr.

PROJECT: Construction of sewage treatment plant (Imhoff tank); sewers, both lateral and intercepting, ranging from 6 to 18-in.; necessary manholes; replacement of pavement; and installation of 3-in. cast iron watermain; at Seneca, Ill.

CONDITIONS: Contractor to furnish all material and complete work in 200 days. Work involves large amount of rock excavation. Rail and highway transportation facilities available. Wage rates are: skilled labor, $1.25 to $1.75 per hour; semi-skilled, $1.125 to $1.60; and common labor, 90c. to $1.00.

BIDS: Twelve bids were received December 17, 1943, ranging from the contract low of $135,886 to $237,223.

LIST OF BIDDERS:

1. Arcole Midwest, Chicago, Ill. (contract) $135,887
2. Gjellafold Constr. Co., Forest City, Iowa 137,212
3. Mancini & Ventrella, Chicago, Ill 138,989
4. Elmer Gust, Oshkosh, Wis 143,672
5. Santucci Constr. Co., Skokie, Ill 154,686
6. D. L. Amici Co., Stone Park, Ill 156,416
7. Joseph J. Duffey Co., Chicago, Ill 164,800
8. George D. Hardin, Chicago, Ill 168,505
9. E. H. Marhoefer, Jr., Co., Chicago, Ill. 173,707
10. T. F. Clogessy Constr. Co., Hammond, Ind 203,060
11. United Constr. Co., Grand Rapids, Mich. 227,177
12. Public Constr. Co., Hammond, Ind 237,223

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Sewage treatment plant	Lump Sum	$29,500.00	$29,800.00	$38,000.00
2. Rock excavation	6,100 c. y.	6.10	7.00	4.00
3. 18-in. sewer	1,500 l. f.	3.88	3.00	4.00
4. 15-in. sewer	140 l. f.	4.80	6.00	3.00
5. 12-in. sewer	3,084 l. f.	2.68	2.50	2.75
6. 10-in. sewer	3,252 l. f.	3.49	2.00	2.50
7. 8-in. sewer	13,571 l. f.	1.60	1.50	2.00
8. 6-in. sewer	3,000 l. f.	1.31	1.50	1.50
9. 12-in. cast iron sewer	200 l. f.	4.87	7.00	6.00
10. 10-in. cast iron sewer	130 l. f.	6.58	6.00	5.50
11. 8-in. cast iron sewer	500 l. f.	3.44	5.00	5.00
12. 6-in. cast iron sewer	750 l. f.	2.56	3.00	4.00
13. Manholes	93 ea.	90.00	100.00	100.00
14. 6-in. macadam road replacement	877 s. y.	1.70	3.00	2.00
15. 3-in. cast iron watermain	900 l. f.	2.20	1.50	2.00

TIMBER AND STEEL GROINS DELAWARE

OWNER: Delaware State Highway Department, Dover.

PROJECT: Construction of identical timber and steel groins at Rehoboth Beach and at Bethany Beach, Del., to protect roadway, shore and beach areas against wave action.

CONDITIONS: Contractor to furnish all materials and complete projects by June 1, 1944. Rail, highway and water transportation facilities available at Rehoboth Beach, and highway and water transportation available at Bethany Beach. Prevailing wage rates to be paid.

BIDS: Three bids were received on each project December 1, 1943, and in each case they ranged from $10,701 to $19,450.

Rehoboth Beach Groins

LIST OF BIDDERS:

1. George E. Shockley, Rehoboth Beach, Del. (contract) $10,701
2. Arnold M. Diamond, Brooklyn, N. Y. 17,295
3. Eisenberg Constr. Co., Camden, N. J. 19,450

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Creosoted timber piles	2,290 l. f.	$1.90	$2.50	$3.00
2. Creosoted timber wales	5.4 M bm.	200.00	300.00	500.00
3. Creosoted sheet piles	1.5 M bm.	180.00	300.00	420.00
4. Steel sheet piles	50 ton	100.00	190.00	180.00

Bethany Beach Groins

LIST OF BIDDERS:

1. George E. Shockley, Rehoboth Beach, Del. (contract) $10,701
2. Arnold M. Diamond, Brooklyn, N. Y. 17,295
3. Eisenberg Constr. Co., Camden, N. J. 19,450

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Creosoted timber piles	2,290 l. f.	$1.90	$2.50	$3.00
2. Creosoted timber wales	5.4 M bm.	200.00	300.00	500.00
3. Creosoted sheet piles	1.5 M bm.	180.00	300.00	420.00
4. Steel sheet piles	50 ton	100.00	190.00	180.00

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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

LUMBER PRICES provide the only major change in the construction material price list for February. Short-leaf yellow pine is 50c. to $6.50 per M ft. higher in Cincinnati; up to $1.00 to $2.00 on most 1- and 2-in. sizes in New York; and up $6.00 to $9.00 on planks in Philadelphia. Douglas Fir increased $1.50 to 1.75 on 1-in. and 2x4-in. and 2x6-in. sizes, but is $1.00 lower on 2x8-in. and 2x10-in. sizes in Los Angeles. It is up 50c. to $1.75 in San Francisco. Fir timbers are lower in Boston, Los Angeles, Philadelphia and San Francisco.

Cement, sand and gravel, crushed stone, and ready-mixed concrete unchanged from last month, and no changes are reported in paving brick and asphalt prices.

Hoisting engineers' rate now ranges from $1.50 to $1.625 per hour Denver, whereas the lower rate formerly prevailed. Other skilled construction workers' hourly rates are unchanged, and common labor rates remain at January levels.

CEMENT, AGGREGATES, READY-MIXED CONCRETE—F.O.B. CITY

	PORTLAND CEMENT (Per bbl., C/L lots, bbl. for bags, cash dis.)		PORTLAND CEMENT (incl. 40c. per bbl. for bags, not deducted)	SAND AND GRAVEL (Per ton, carload lots)			CRUSHED STONE (Per ton, carload lots)		CRUSHED SLAG (Per ton, carload lots, f.o.b. plant)		CONCRETE BLOCK 8x8x16-in.; truckload del.; per block		READY-MIXED CONCRETE
	Cloth *a*	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand-grav.	Lt. wgt. Agg.	1:2:4, delivered
Atlanta	$2.77	$2.82	$2.47	$1.79	$1.80	$1.99	$1.79	$1.80	$1.59	$1.69	$0.17	....	
Baltimore	2.33	2.08	1.88	1.75‡	1.75‡	1.25‡	1.75‡	1.75‡	1.75‡	1.75‡	.125	$0.125*e*	7.25
Birmingham	2.50	2.25	2.10	1.75	1.75	1.50	.85	1.00	.90	1.15	.1425	....	5.80
Boston	2.75*b*	2.40*b*	2.30	1.40‡	1.40‡	1.00‡	1.40‡	1.40‡	....	....	.13	.135*e*	7.25
Chicago	2.70	2.45	2.30	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	2.15‡*d*	1.75‡	1.75‡	.16	.16*x*	....
Cincinnati	2.31	2.06	1.81	1.20	1.20	1.10	1.80	1.80	....	....	.12	.18*e*	6.60
Cleveland	2.39	2.14	....	1.70*i*	1.55*i*	1.60*i*	1.73*i*	1.73*i*	1.73*i*	1.73*i*	.14	.15	7.30
Dallas	2.52	2.27	2.07	1.50*p*	1.70*p*	1.10*p*	1.69*p*	1.79*p*	....	....	.15	....	6.25
Denver	3.08	2.88	2.32	1.20	1.30	1.25	1.65	1.75	1.00	1.00	.15	....	7.25
Detroit	2.39	2.14	1.99	1.50	1.50	1.50	2.25	2.25	2.00‡	2.00‡	.14	.14*w*	7.00
Kansas City	2.58	2.33	2.18	1.85	2.30	1.00	1.91	1.91	....	....	.125	.125*uy*	7.80
Los Angeles	3.00*v*	2.40*v*	....	1.30	1.30	1.15	1.30*f*	1.30*f*	....	....	.04½*b*	.10*ss*	7.25
Minneapolis	2.90	2.65	....	1.00*h*	1.00*h*	.25*h*	1.00*h*	1.00*h*	....	....	.12	.16	7.60
Montreal	....	1.95*rs*	1.79*rs*	....	1.65‡*t*	2.05‡*t*	1.05*ct*	1.15*ct*	....	....	.14*t*	.14*ct*	7.00
New Orleans	2.41	2.16	1.96	1.65	1.65	.90	....	....	....	....	.19	....	9.25
New York	2.60‡	2.44‡	....	1.60*de*	1.60*de*	.90*dc*	1.70*de*	1.80*de*	....	....	.14*cc*	.14*ccc*	7.80
Philadelphia	2.33	2.08	1.88	1.55‡	1.55‡	1.20‡	1.90	1.95	1.10	1.10	.155	.155*cc*	8.20
Pittsburgh	2.45	2.20	2.00	1.65‡	1.65‡	1.85‡	2.25‡	2.25‡	1.50	1.50	.17	.17*z*	8.25
St. Louis	2.80	2.52	....	1.75‡	1.50‡	1.25/1.50‡	1.10*h*	1.10*h*	.75*g*	.75*g*	.13	.15*y*	8.00
San Francisco	....*u*	2.21	1.91	1.36	1.36	1.36	1.46	1.46	....	....	....	.20*ss*	7.80
Seattle	2.95*o*	2.75*o*	....	1.00*o*	1.00*o*	1.00*o*	2.00*o*	2.00*o*	....	....	.16	.16*y*	7.25

‡ Delivered. *a* 10c. allowed for each returnable bag. *b* 10c. per bbl. off for cash. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* F.o.b. Granite City, Ill. *h* F.o.b. plant. *i* Within three miles of Public Square. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* Up to 200 cu. yd. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 10c. per ton off, cash 15 d *r* 10c. per bbl. off, cash 20 days. *s* 8% sales tax included. *t* 8% sales tax not included. *u* Price withdrawn. *v* 20c. per bbl. discount; 20c. allowe returnable cloth bag. *w* Cinder. *x* Waylite. *y* Haydite. *z* Celo *aa* Pumice. *bb* 4 x 8 x 12 in. *cc* Also 8 x 18 x 18 in.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash dis 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICES RECEIVED AT CEMENT MILL

Charge for bags not included. For cloth bags, add 40c. per bbl.; 10c. refund allowed for each returnable bag; for paper bags add 15c. per bbl., not refundable

	Bagged	Bulk
Buffington, Ind	$1.70	$1.65
Dallas, Tex. (Inc. 9c. tax)	1.84	1.79
Hannibal, Mo	1.70	1.65
Hudson, N. Y	1.75	1.70
Independence, Kans	1.70	1.65
Ironton, Ohio	$1.60	$1.55
Limedale, Ind	1.70	1.65
Norfolk, Va	1.75	1.70
Northampton, Pa	1.55	1.50
North Birmingham, Ala	1.70	1.65
Richard City, Tenn	$1.80	$1.7
Steelton, Minn	1.80	1.7
Universal, Pa	1.65	1.6
Waco, Tex. (Plus 9c. tax in Tex.)	1.75	1.6
Montreal (8% sales tax incl.)	1.68	1.6

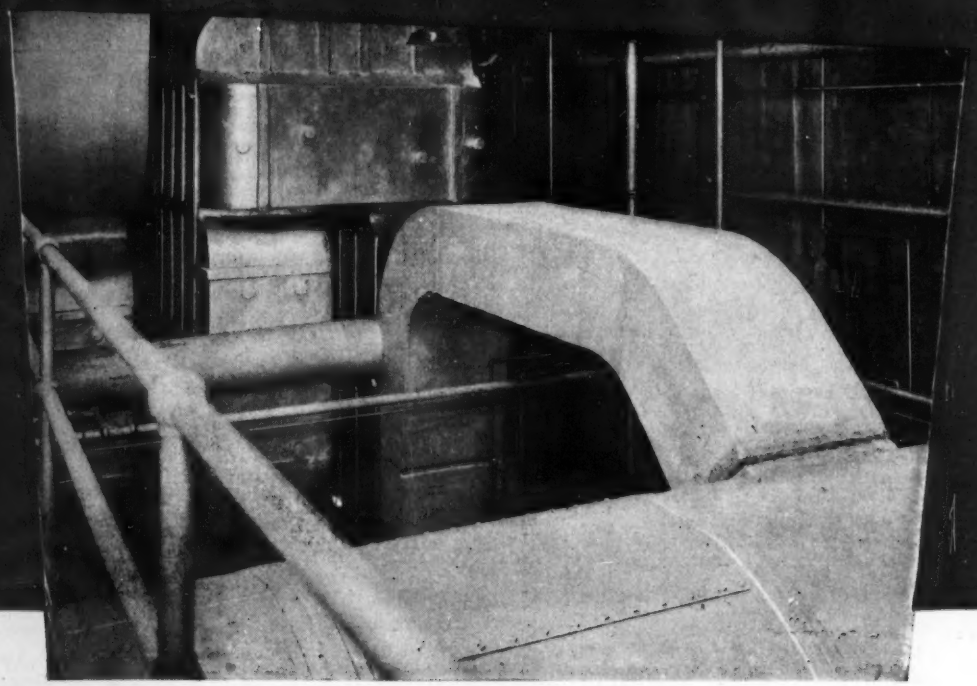
Discount 10c. per bbl. 20 days

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS—F.O.B. CITY

	PAVING BRICK AND BLOCK: Granite (per M. lots of 50,000)	Brick (per M 3x4x8½ in.)	Wood (per sq. yd. 3½ in.)	PAVING ASPHALT (Per ton, less than 80 penetration)		ASPHALT BINDERS—FLUXES (Per gal., 80-300 penetration)		CUTBACK ASPHALT (Per ton)		ROAD OIL (Per gal.)	ASPHALT EMULSION (Quick-breaking) (Per gal.)	
	4x4x8 in.	carload lots	16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$39.35	$2.25	$18.53*e*	$24.62*e*	$0.0740*e*	$0.1309*e*	$0.0802*he*	$0.1348*h*	$0.0676*e*	$0.0826	$0.1
Baltimore	150.00‡	48.00	80.00*m*	15.00*r*	21.00*r*	.06*r*	.09*r*	13.00*r*	23.00*r*	.065*r*	.07*r*	.1
Birmingham	150.00	48.00	.....	17.95	.....†	.0747	.....†	.0834*h*	.....†	.065	.09	....
Boston	80.00	57.00	3.75	14.20	20.00	.....‡	.....	.....	.....	.....	.....	.....
Chicago	150.00	55.00	1.80/2.00*d*	14.00	22.50	13.00*g*	21.50*g*	.0575*h*	.15*h*	.05*n*	.09/10*n*	.13/
Cincinnati	120.00	50.00	.....	16.40	.....	.085	.....	12.25	.....	.07	.085	....
Cleveland	118.00	37.50	2.50	17.00	19.00	.085	.095	.10*h*	.15	.095	.09	.09
Dallas	.....	36.00	.....	13.65	20.30	.06	.11	16.00	24.80	.06	.05/.07	.07/
Denver	.....	66.11	.....	11.00	.....	10.00	.....	.045*h*	.....	.....	.....	....
Detroit	.....	37.50	.....	18.06*f*	25.60*f*	.0743	.128	.0718*h*	.119*h*	.067	.0775	.10
Kansas City	.....	40.00	.....	18.50	23.50	.077	.1075	.077*h*	.107*h*	.057	.11	.15
Los Angeles	.....	50.00	.....	9.00*b*	23.00	9.50*bg*	24.00*bg*	9.50*b*	.....	.025	.072	.15
Minneapolis	.....	.....	2.30*d*	.....	27.70	.....	.126	.....	32.64	.....	.....	....
Montreal	92.40	.....	.....	16.60*k*	24.25*k*	.116*k*	.1485*k*	.115*hk*	.135*hk*	.08*k*	.135*k*	.18
New Orleans	.....	.....	.....	13.50*a*	20.00*a*	.057	.088	.06*h*	.095*h*	.....	.080	....
New York	.....	70.00	.....	17.40	24.20*p*	14.00	.....	.0725*h*	.1325*hp*	.....	.0725*p*	.12
Philadelphia	140.00	58.00	4.06	15.00*r*	.....	14.00*r*	.....	.065*hr*	.....	.....	14.00*rr*	....
Pittsburgh	135.00	38.75	.....	18.00	23.00	.09	.16	20.00	36.00	.07	.06	.11
St. Louis	.....	37.00	.....	16.00	22.00	15.00*g*	21.00*g*	.0575*h*	.1213*h*	.048	.0525	.12
San Francisco	.....	40.00	.....	10.90	21.15	10.90*g*	18.00*gr*	12.90	17.50*r*	9.50*gr*	.0525	.12
Seattle	.....	60.00*c*	.....	10.90*i*	23.40*i*	.....	20.40*gi*	11.40*i*	.....	.....	.0525*i*	.09

‡‖ Delivered. *a* F.o.b. Baton Rouge. *b* Delivered to purchaser's warehouse. *c* 3½x4x8½ in. *d* 2½ in. 12-lb. treatment. *e* Local reduction due to 20% reduction intra-state class freight rates, only Georgia affected. *f* Mexican. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* 3x3½x8½ in. *k* Tax included. *m* thousand. † Available on priority only and quoted specially. *p* No used shipments except to armed forces. *r* February 1943 prices, none later available.

WPB eases restrictions on *Aluminum Paint*



There is still a war on! But now the bars have been let down a bit on the use of aluminum paint. Further lifting of restrictions can be expected when conditions warrant it.

WPB amended order M-1-g now permits interior uses wherever excessive moisture, fumes or temperatures prevail. That would apply in power plants, incinerators, boiler rooms, sewage disposal plants, water works and many industrial and commercial establishments.

For most exterior uses, such as touching up bridges already painted with aluminum paint, special approval must be sought from WPB, Aluminum & Magnesium Section, Washington, D.C. Special consideration is promised where it can be shown that aluminum paint is materially better than other paints for the job. In addition to covering that point, your application should state how much paint pigment is needed, where it will be purchased and what priority rating you have.

If you have any questions as to how the WPB order fits your particular case, or if you wish to have a copy of the official order, M-1-g, write **ALUMINUM COMPANY OF AMERICA, 1812 Gulf Building, Pittsburgh, Pa.**

ALCOA

7 ADVANTAGES OF ALUMINUM PAINT

- High durability
- High reflectivity
- High hiding power
- Resistance to moisture
- Resistance to fumes
- Resistance to heat
- Attractive appearance

IRON AND STEEL PRODUCTS—BASE MILL PRICES

	STRUCT. SHAPES-PLATE	REINF. BARS ¼-in billet *b*	RIVETS ½-in. structural	WIRE NAILS Base *d*	SHEET PILING Base	STEEL RAILS Per Gross Ton Standard	Light	Re-rolled	TRACK SUPPLIES Angle Bars	Std. Tie Plates *c*	Track Bolts
Birmingham	$2.10	$2.15	$3.75	$2.55	.....	$40.00	$40.00	$39.00	$2.70	$3.00	$2.15
Chicago	2.10	2.15	3.75	2.55	$2.40	40.00	40.00	39.00	2.70	3.00	2.15
Pittsburgh	2.10	2.15	3.75	2.55	2.40	40.00	40.00	39.00	2.70	3.00	2.15
Buffalo	2.10	2.15	.....	.....	2.40	.....	.....	.....	.....	.....	2.15
Cleveland	2.10	2.15	3.75	2.55	.....	.....	.....	.....	.....	.....	.....
Youngstown	.....	2.15	.....	.....	.....	.....	.....	.....	.....	3.00	.....
Detroit	.....	2.27‡	.....	.....	.....	.....	.....	.....	.....	.....	.....
Gulf ports	2.47*a*	2.52*a*	.....	.....	2.85*a*	.....	.....	.....	.....	.....	.....
Pacific ports	2.75*a*	2.80*a*	.....	3.05	2.95*a*	.....	.....	.....	.....	.....	2.30

‡ Delivered. *a* F.o.b. cars dock. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone, Steelton, Pa., spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per c

IRON AND STEEL PRODUCTS—F.O.B. WAREHOUSE, PER 100 LB., BASE PRICE

	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS* Per 100 lb., ¾ in., base price 15 tons or over *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb	Std. ribbed 3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq.yd., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in. No. 6 & 6 wires Per sq. yd	SHEET PILING Per 100 lb. base price
Atlanta	$2.34	$2.40	$2.40	$.02½	$.10	$21.06	$23.00	$1.82	$1.35	$0.1719	$3.04
Baltimore	3.70	2.90	2.75	.....	.10	22.50	24.50	1.70	1.27	.1611	3.00
Birmingham	2.10*a*	2.15	2.15	.02½	.10	19.00	21.00	1.80	1.34	.1701	....
Boston	3.85	3.51	3.36	$20 C.L.	.10	18.50	29.50	1.76	1.31	.1656	2.70
Chicago	2.10*a*	2.15	2.15	.03	.05	21.50	23.50	1.67	1.25	.1575	2.40
Cincinnati	3.68	2.53*cd*	2.53*cd*	.....	.05	19.50	21.50	1.66	1.25	.1566	....
Cleveland	2.10*a*	2.15	2.15	.02½	.10	19.50	21.00	1.66	1.25	.1566	....
Dallas	4.25	3.17	3.17	.....	....	25.00	27.50	1.93	1.42	.1827	....
Denver	4.57	4.842	3.85	.....	....	26.50	26.50	1.97	1.45	.186	....
Detroit	3.65‡	2.52‡	2.52‡	.....	.10	30.00	30.00	1.68	1.26	.1584	2.66
Kansas City	4.19	2.61*cd*	2.61*cd*	.0	.05	24.50	26.50	1.78	1.33	.1683	2.674
Los Angeles	3.65*f*	2.575	2.425	.02½	.05	23.00	27.50	1.93	1.42	.1827	3.65
Minneapolis	3.81‡	2.73	2.73	.0	.10	25.00	27.00	1.80	1.34	.1701	2.736
Montreal	4.00*i*	2.90*i*	2.80*i*	.....	....	26.00*hij*	33.00*hij*	2.25*i*	3.14*i*	.228*i*	....
New Orleans	4.229‡*k*	2.52	2.52	.05	.10	19.00	21.00	1.82	1.35	.1715	2.875
New York	3.75	2.76*e*	2.76*e*	.....	.15	17.50	19.50	1.76	1.32	.1665	2.74
Philadelphia	3.66	3.82	....	.....	....	19.50	21.50	1.71	1.28	.1611	2.72
Pittsburgh	2.10*a*	2.15	2.15	.02½	.10	23.00	26.50	1.59	1.20	.1503	2.40
St. Louis	3.697	2.74	2.74	.0	.05	28.00	34.00	1.69	1.27	.1602	2.70
San Francisco	4.35	2.825	2.675	.02½	.10	21.00	24.50	1.93	1.42	.1827	3.85
Seattle	2.75*e*	2.80*e*	....	.....	....	34.50	38.50	1.93	1.42	.1827	2.95*d*

‡ Delivered. *a* Mill prices. *b* 5–15 tons, add 15c. 1–5 tons, add 25c. Less than 1 ton, add 50c. *c* 20 tons or over Base. *d* Mill price plus freight. *e* F.o.b. dock. *f* Includes delivery in free delivery zone. *g* Less than 1 ton, add 25c.; 1 to 5 tons, add 10c. * High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. *i* Plus Dominion and Province sales tax. *j* August 1942 price; not on market. *k* Quotation on changed basis; no actual price change.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in.*a*	VITRIFIED SEWER PIPE Per foot, std. 8 in., s.s.	Delivered std. 12 in., s.s.	ASTM 24 in.,	C13–35 36 in.,	CLAY DRAIN TILE Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTM 12 in.	C 14–35 24 in.	WROUGHT STEEL PIPE Full standard weight, *h* 1 to 3 in., Black %	Galv. %	Butt Weld 3½ to 6 in.; Black %	Galv. %	Lap Weld
Atlanta	$49.66	$0.26*b*	$0.468*bc*	$1.8525	$4.68*c*	$55.00	$128.00	$0.45	$1.642	48.2	54.2	59.7	51.3	
Baltimore	53.00	.35	.60	2.65	7.25	160.00	200.00	.50	1.75	65.5	57.5	63.0	54.0	
Birmingham	45.00	.275	.495	1.95	5.50	100.00	220.00	.50	1.70	62.2	54.2	59.7	51.3	
Boston	55.40	.26	.463	2.07	5.85	.....	.....	.60	.....	....	....	....	....	
Chicago	54.33	.35	.675	2.70	7.00	100.00‡	150.00‡	.45	1.85	66.0	55.0	64.5	53.0	
Cincinnati	53.27	.231	.4455	1.80	5.125	105.00	170.00	.60	1.70	57.1	43.4	54.0	39.6	
Cleveland	54.75	.224*rs*	.432*rs*	1.80*rs*	5.125*rs*	90.60	139.40	.36	1.60	68.5	57.5	66.0	54.0	
Dallas	56.43	.31	.58	2.25	5.00	90.00	110.00	.46	1.57	59.9	51.9	57.3	48.3	
Denver	61.56	.29†	.52†	2.16†	3.00*n*	125.00	200.00	1.00	2.22	58.4	50.4	55.7	47.3	
Detroit	54.75	.35	.675	2.70	7.75	135.00	200.00	.40	1.75	57.7	44.0	54.8	40.6	
Kansas City	55.73	.315	.39	2.20	5.86	140.00	260.00	.45	1.60	35.9	46.4	46.6	39.9	
Los Angeles	68.40	.282†	.508†	2.034†	5.985†	115.50	192.50	1.00	2.00	61.1	50.1	58.6	47.1	
Minneapolis	59.00	.275†	.495†	1.98†	5.37†	.....	.....	.90	2.10	64.2	53.2	60.7	49.3	
Montreal	67.00	.85*o*	1.50*o*	5.25*p*	8.50*ep*	45.00*m*	64.00*m*	.45*m*†	1.92*m*†	....	....	....	....	
New Orleans	51.78	.26	.48	1.60	.....	150.00	220.00	.45	1.65	62.4	54.4	58.8	50.3	
New York	52.40	.308	.594	2.52	6.45	.....	.....	.60	1.40	64.9	53.9	62.4	50.9	
Philadelphia	51.00	.30	.58	2.50	7.50	150.00	225.00	.45	1.75	56.6	42.8	53.6	39.1	
Pittsburgh	56.00	.245†	.4725†	1.845†	5.4325	97.80	154.20	.85*g*	2.00*g*	68.5*i*	57.5*i*	66.0*i*	54.8*i*	
St. Louis	53.62	.28	.504	2.016	4.50	85.00	220.00	1.25*j*	2.25*k*	56.4	42.6	52.5	38.4	
San Francisco	68.40	.3625*d*	.6525*d*	2.61	6.52	115.00	192.50	.53	2.34	45.0	31.0	41.0	28.0	
Seattle	70.20	.375	.675	2.70	6.75	84.00	187.50	.51*f*	1.44*f*	....	....	....	....	

‡ Delivered. †F.o.b. *a* B. & S. class B and heavier, C/L lots, 200 tons and over Burlington, N.J. (base) $49.00. Based on existing freight rates; subject to rate change. Gas pipe and class A, $3 per ton additional, 4 in., $3 per ton additional, 30 in. and larger usually $2 per ton less. *b* Double strength. *c* List to dealer. *d* List. *e* 30-inch. *f* Less 5% for cash. *g* Culvert pipe. *h* Discounts from standard list consumers carload prices, except Pittsburgh prices are f.o.b. mill. Base price $200 per net ton. List prices per ft.; ¾ in., 8¢.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92. 3 percent tax on transporation costs not included. *i* Applies also at Lorain, Ohio, mills. Chicago delivered base is 2½ points on butt, 1½ on lap. Freight is figured from Pittsburgh, Lorain, O., Chicago Dist. Billing is from point producing lowest price at destination. WROUGHT IRON PIPE: Base price and list prices per ft. same as wrought steel pipe. Discount for Pittsburgh base: Butt-weld—1 in. and 1¼ in. black 34, galv. 16; 1½ in. black 38, galv. 18½; 2 in. black 37½, galv. 18. Lapweld—2½ in. to 3½ in. black 31½, galv. 14½; 4½ in. to 8 in. black, 32½ galv. 17. *j* Reinforced; spec. C 76–37. *k* Reinforced; spec. C 75–37. *l* Plus sales tax. *m* Tax included. *n* 27-in. pipe. *o* Less 50%. *p* Less 53%. *r* Truck delivery. *s* Also Jan. prices.

NEWS OF THE WEEK

(Continued from page 174)

NHA prefabricated houses moved 200 miles

The National Housing Agency's initial for operation in moving pre-fabri-ed houses from one site to another is re than three-fourths complete, with work still progressing satisfactorily, ording to the NHA. One hundred five buildings, comprising 200 ellings, are being moved 200 miles m the Kingsbury-LaPorte, Ind., area Port Clinton, Ohio, to house ordnance kers.

The buildings are part of 2,960 units cted at the Indiana site. Because the sent moving project is considered factory, plans are under way to e an additional 1,000 units to a ination not yet determined. These es, an NHA spokesman said, are in with the agency's original purpose putting up pre-fabricated dwellings type that could be dismantled and ed elsewhere as needed.

The buildings being transferred are hree different types: Those prefabri-d by the National Homes Corp., plywood both inside and out; dings produced by General Fabri-rs, using Prestwood for both ex-r and interior; and structures built Hussman Ligonier Co., which have t-rock interiors and vertical ¾-in. d siding on the exterior.

Two 30-ft. trailer trucks are required transport the dismantled parts for building. It was found little dam-occurred in transit. Although it been estimated that 50 percent of asphalt roofing would have to be re-ed, it was found that only 15 per-new roofing was needed.

The lump-sum contract for disman-, moving and reassembling the ctures is held by Henke Construc-Co., Chicago. The $384,000 contract includes $250,000 for actual de-nting, loading, transporting, and ecting, $114,000 for site improve-ts, and $20,000 for three new struc-s.

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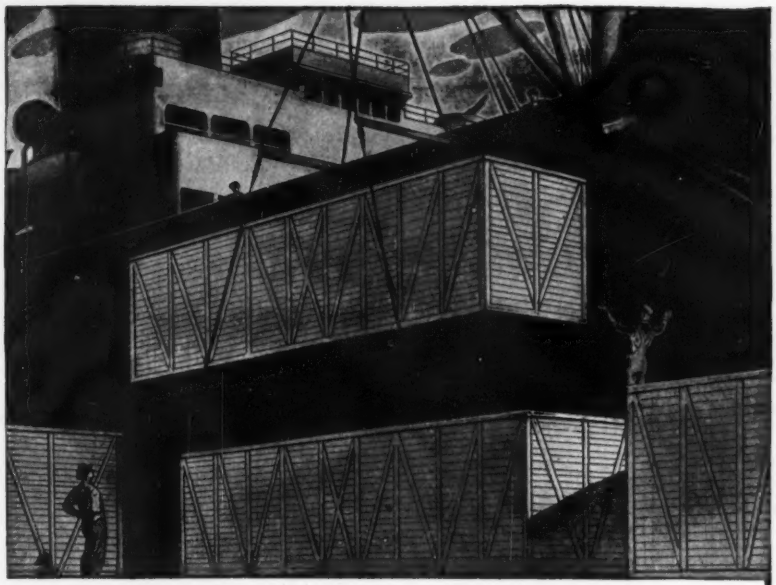
California road ruling favors property owners

the face of arguments that the 's action, if allowed to stand, d render prohibitive the cost of way construction work in the state,



Why not flame-proof the wood that goes into packing cases?

Flame-proofed lumber, used in the cases carrying war materials overseas, would greatly lessen the hazard of fire aboard snips and in storage. Here's insurance against fire for every trip these returnable cases make, at only the slight additional cost of the original treatment for the wood.

Minalith* fire retardant, driven deep into the wood by vacuum-pressure treatment, makes ordinary wood flame-proof. It does not support combustion or spread fire. Structural members retain their high strength without sudden collapse when exposed to flame. This flame-proofed lumber has been widely used in the war effort; for warehouses, blimp hangars, and the like.

Wolmanized Lumber*, the wood that's impregnated with Wolman Salts* preservative, has found even wider use in wartime construction. From U. S. training camp to farthest military outpost, this pressure-treated wood is safeguarding structures against decay and termite attack.

Postwar builders will find both of these types of treated lumber similarly valuable. And all of the usual advantages of building with wood are retained. American Lumber & Treating Company, 1649 McCormick Building, Chicago 4, Illinois.

*Registered trade marks

WOOD THAT'S Alloyed FOR SAFETY AND ENDURANCE

AMERICAN LUMBER & TREATING COMPANY

LUMBER, TIMBER PLYWOOD—PER M FT., B.M., CARLOAD LOTS F.O.B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) — *All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)*								LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 R.L.	6x12 R.L.	12x12 R.L.	2x12 R.L.	12x12 R.L.	¼"	⅜"
Atlanta	$37.00	$37.00	$32.00	$31.00	$31.00	$34.50	$46.00	.....	.....	$54.00	$64.00	$17.90	$21.85
Baltimore	42.00	45.00	42.00	42.00	43.00	48.00	65.00	.....	.....	115.00	120.00	18.25	22.25
	48.00	*48.00*	*55.00*	*55.00*	*55.00*	*55.00*	*68.00*	*$70.00*	*$70.00*	.....	.....	.....	.....
Birmingham	34.50	36.50	32.00	32.00	34.00	34.00	53.00	53.00	56.00	.....	.....	17.35	21.15
[1]	37.50	37.50	37.00	37.00	37.00	43.00	65.00	.....	.....	.....	.....	.....	.....
Boston ‡*	42.00[3]	45.00[3]	55.00[3]	60.00[3]	60.00[3]	65.00[3]	68.00[3]	.....	.....	72.00[3]	72.00	18.25	22.25
‡*	*50.00*	*50.00*	*56.00*	*60.00*	*65.00*	*65.00*	*72.00*	*72.00*	*72.00*	.....	.....	.....	.....
Chicago	50.00	51.00	50.00	49.00	50.00	54.00	67.00	.....	.....	80.00[3]	95.00[3]	14.60	17.80
	50.00	*50.00*	*47.50*	*47.00*	*47.00*	*48.00*	*57.00*	*56.00*	*58.00*	.....	.....	.....	.....
Cincinnati	47.50	49.00	42.50	42.50	42.50	44.50	67.00	.....	.....	65.00	65.00	17.35	21.15
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	42.50[k]	42.50[k]	52.50[k]	51.00[k]	65.00	65.00	83.00	83.00	83.00	.....	.....	17.75	21.60
Dallas [c]	44.25	44.25	41.50	40.00	40.00	42.00	57.50	55.50	55.00	83.50	80.50	14.60	17.80
Denver ‡	64.00[3]	62.00[3]	65.00[3]	65.00[3]	65.00[3]	66.00[3]	69.00[3]	*68.00*	*69.00*	.....	.....	10.45	13.70
Detroit	61.00	61.00	57.75	57.75	57.75	62.75	72.75	75.00	90.00	70.75	90.00	17.35	21.15
	57.00	*57.00*	*57.00*	*57.00*	*62.75*	*63.75*	*71.00*	*75.00*	*75.00*	.....	.....	.....	.....
Kansas City [a]	64.00	64.00	62.00	60.50	62.00	64.00	79.00	.....	.....	79.00	89.00	12.60	15.40
	60.00	*60.00*	*58.00*	*58.00*	*58.00*	*58.00*	*75.00*	*80.00*	*80.00*	.....	.....	.....	.....
Los Angeles [a]	*60.00*	*60.00*	*60.50*	*60.75*	*59.25*	*59.25*	*72.75*	*72.00*	*72.00*	.....	.....	9.90[h]	13.05[h]
Minneapolis [b]	59.00[3]	59.00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	12.60	15.40
‡	*56.00*	*56.00*	*55.75*	*56.00*	*55.50*	*56.25*	*65.25*	*62.00*	*62.00*	.....	.....	.....	.....
Montreal [†]	*58.00*	*61.00*	*54.00*	*58.00*	*60.00*	*66.00*	.....	.....	.....	200.00	200.00	.....	.....
	48.50	*48.50*	*45.25*	*45.25*	*45.25*	*46.75*	*50.00*	*50.00*	*50.00*	.....	.....	.....	.....
New Orleans	37.50	37.50	32.50	31.50	31.50	35.00	46.00	.....	.....	52.50	69.00	14.60	17.80
	31.00	*31.00*	*33.00*	*31.00*	*34.00*	*32.00*	*33.00*	.....	.....	.....	.....	.....	.....
New York	62.50	62.50	57.50	57.50	57.50	59.00	74.00	.....	.....	120.00[f]	125.00[f]	18.35	22.25
‡	.....	.....	*65.00[i]*	*65.00[i]*	*65.00[i]*	*65.00[i]*	[Range from $75 to $95]			.....	.....	.....	.....
Philadelphia	65.00	70.00	70.00	70.00	70.00	70.00	75.00	.....	.....	130.00	130.00	18.25	22.25
	70.00	*75.00*	*70.00*	*70.00*	*70.00*	*70.00*	*85.00*	*90.00*	*90.00*	.....	.....	.....	.....
Pittsburgh	50.80	53.20	62.75	55.00	60.85	62.50	76.25	.....	.....	.....	.....	18.10	22.05
	69.80	*68.10*	*66.10*	*65.80*	*65.80*	*65.65*	*83.75*	*85.75*	*88.75*	.....	.....	.....	.....
St. Louis [e]	56.00	56.00	53.00	52.00	52.00	55.00	69.00	*75.00*	*75.00*	86.00	85.00	14.60	17.80
San Francisco [d]	*36.50*	*36.50*	*35.50*	*35.75*	*34.75*	*34.75*	*38.50*	*38.00*	*38.00*	.....	.....	7.30[g]	8.90[g]
Seattle	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*35.00*	*40.00*	*40.00*	*40.00*	.....	.....	0.00	0.00

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [2] Roofers' N. C. Pine. [3] Spruce. [4] Native. [5] Western Pine, No. 3 Common. [7] Spruce. [8] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Contractors discount in Minneapolis and St. Paul discontinued May 21, 1938. *c* 5M ft. or less. *d* F.o.b. cars San Francisco freight rate. *e* 10% discount taken off. *f* Up to 18 ft. † Plus sales tax. * Prices for truck delivery; no longer quoting carload lots f. o. b. city.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface Seattle base price on ¼", $95.15; on ⅜", $104.85; price includes oiling and sealing charges. For other centers add rail freight increment from table or proper size. For resin dipped treatment, add $10.50 per M. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* Ranges from $65 to $69. *j* Average price. *k* August 1943 price. *l* September price; none later available.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Aug. 15, 1938 — Single or Double Thickness A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50-lb. cases delivered in 200 lb. lots*	
Atlanta	75%	75%	$0.15	
Baltimore	78%	79%	.15	
Birmingham	76%	76%	.105	
Boston	77%	78%	.15	
Chicago	77%	77%	.15	
Cincinnati	77-10%	77-10%	.15	
Cleveland	77-10%	77-10%	.19	
Dallas	76%	76%	.1625	
Denver	76%	76%	.155*e*	
Detroit	77%	77%	.1575	
Kansas City	77-10%	77-10%	.155	
Los Angeles	86%*d*	88%*d*	.1575	
Minneapolis	77%	77%	.155	
Montreal	40-10-5*ab*	40-10-10*ac*	.1675†	
New Orleans	70%	75%	.16	
New York	81%	82%	.22*f*	
Philadelphia	78%	79%	.15	
Pittsburgh	79%	79%	.1225	
St. Louis	77-10%	77-10%	.155	
San Francisco	66%	73%	155	
Seattle	75%	75%	.1575†	

Price of 60% Ammonia Gelatin is $0.01 per lb. higher than 40%

a Discount from list Sept. 1939; sales tax included, but 6% tax exemption not allowed for. *b* Single thickness. *c* Double thickness. *d* Discount from jobbers' list Sept. 15, 1928.

* Urban prices influenced by service charges or local storage and delivery regulations, do not consistently reflect quantity prices in less congested areas. *e* F.o.b. Louviers, Colo. *f* In boroughs of Kings, Queens and Richmond, and in Manhattan south of Canal St. add delivery charge of $6.00 per trip † F.o.b.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.105	$0.13	$0.15
W. of Miss. to Rocky Mtn. States, Fla. and Maine	.11 -.1175	.135 -.1475	.155 -.1675
Rocky Mtn. States	.11 -.1225	.135 -.1525‡	.155 -.1725‡
Pacific N. W. States	.1075-.12	.1375-.15	.1575-.17
Pacific S. W. States	.1050-.1125	135 -.1425	.155 -.1625

‡ F.o.b. Louviers, Colo., or Butte, Mont.

PILES, TIES—F.O.B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail—Pine	Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.33	...
12-in.—2-ft. from butt	6-in.	50 to 59-ft.	.34	...
12-in.—2-ft. from butt	6-in.	60 to 69-ft.	.35	...
12-in.—2-ft. from butt	6-in.	90 to 100-ft.	....	.55
13-in.—3-ft. from butt	5-in.	91 to 100-ft.	....	.56
14-in.—2-ft. from butt	6-in.	50 to 69-ft.	.40	.50
14-in.—2-ft. from butt	6-in.	70 to 79-ft.	.41	.57
14-in.—2-ft. from butt	5-in.	80 to 85-ft.	.52	...
14-in.—2-ft. from butt	5-in.	85 to 89-ft.	.55	....
14-in.—2-ft. from butt	5-in.	90 to 100-ft.	....	.59

RAILWAY TIES

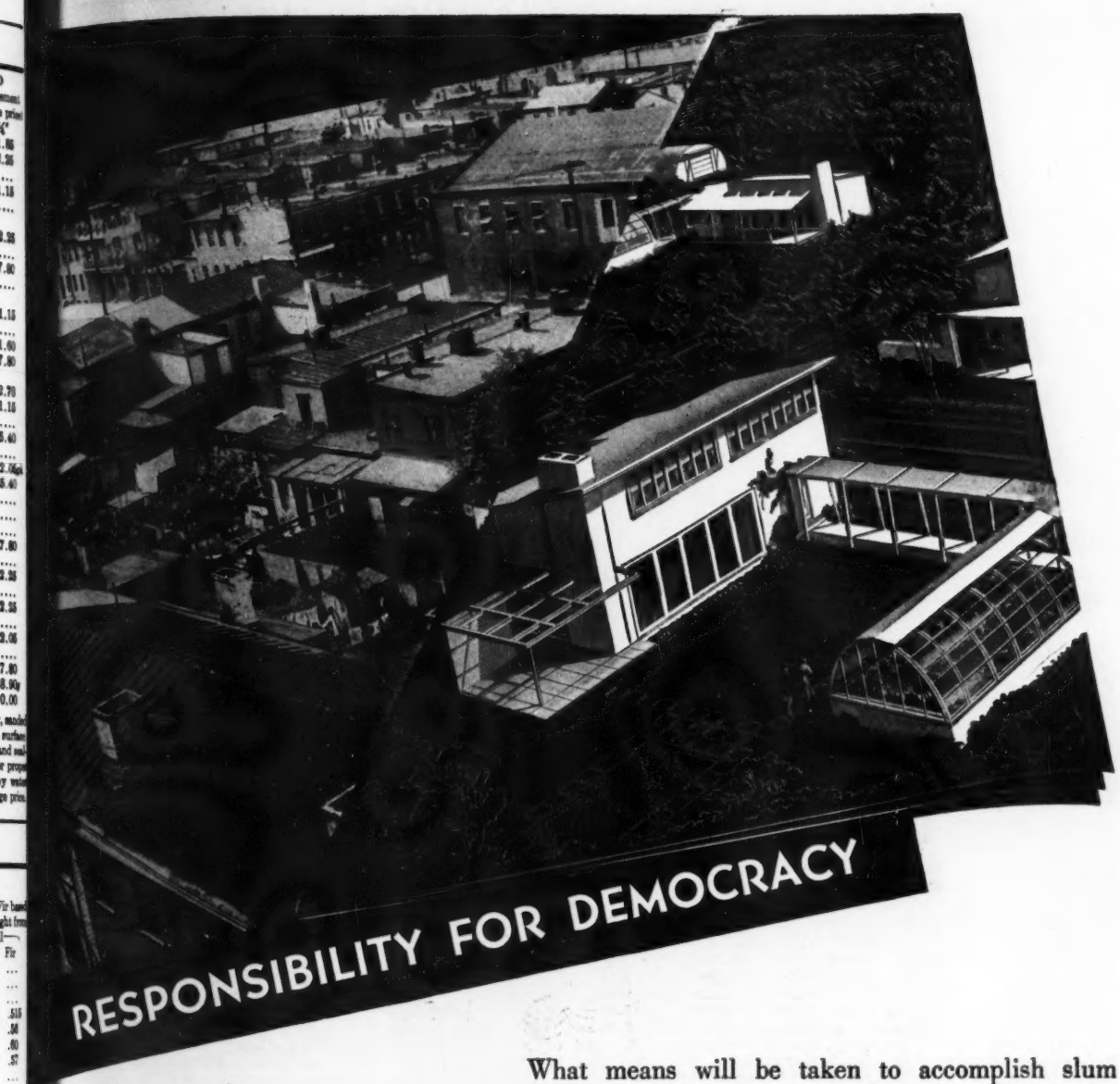
Prices f.o.b., per tie for carload lots:		6"x8"x8' Untr.	6"x8"x8' Tr.	7"x9"x8'9" Untr.	7"x9"x8'9" Tr.
Boston	Oak	$1.50	....	$2.00	....
	Pine	2.00	$3.00*a*	2.50	$3.50*a*
New York	S. L. Sap Pine	1.43/1.54	2.59	1.76	2.88
	Mixed Oak	1.71	2.59	2.42	3.59
Birmingham	White Oak	1.00	1.60*a*	1.30	2.25*a*
Chicago	Red Oak	....	2.19*a*	2.87	3.00*a*
Los Angeles	Douglas Fir	1.10*h*	1.75*ah*	1.60*h*	2.50*ah*
Philadelphia	Red Oak	....	2.10*ag*	....	3.25*ag*
St. Louis	White Oak	1.48	....	2.04	....
	Red Oak	1.48	2.05*a*	2.04	2.85*a*
	Sap Pine or Cypress	1.55	....	1.91	....
San Francisco	Douglas Fir	1.25*bcf*	....	....	3.00*cf*
Montreal	Birch or Maple	.85	.95	....†	....†

Tr.—Treated; Untr.—Untreated. *a* Creosoted *b* 6"x8"x8'6". *c* Empty cell. *d* Zinc. *e* Green. *f* F.o.b. cars. † Out of market. *g* January 1943 prices; none later available. *h* Jan. '44 prices; ties not now available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder, in drums, f.o.b. works, per 100-lb.	$2.50-3.00
Chlorine cylinders, liquid, per lb. delivered	.08
Calcium chloride, 77-80%, flaked, 100-lb. paper bag, del'd, ton	18.50-35.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.40
Soda ash, 58%, in paper bags, per 100 lb. dense	1.50
Sulphate of aluminum, commercial, in 100-lb. bags, per ton	23.00-35.00
Sulphate of copper, in bbl., per 100-lb.	5.00



RESPONSIBILITY FOR DEMOCRACY

What means will be taken to accomplish slum clearance in the post-war world have not yet been determined. Yet accomplished it must be, for on a decent standard of living depends much that is vital to the future of democracy.

Versatile and efficient, Stran-Steel framing systems provide the building industry with an effective medium of construction for all types of housing developments. They speed erection, safeguard the building investment, and lend themselves to the application of modern methods and materials. Stran-Steel's engineering experience, greatly increased by large-scale wartime assignments, will be at the service of architects and contractors.

Manufacturer of the U. S. Navy's Famous **Quonset Hut**

STRAN STEEL

DIVISION OF GREAT LAKES STEEL CORPORATION
1130 PENOBSCOT BUILDING, DETROIT 26, MICHIGAN

UNIT OF NATIONAL STEEL CORPORATION

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME—DELIVERED

	STRUCTURAL CLAY TILE—PARTITION—SCORED			STRUCTURAL CLAY TILE—LOAD BEARING—SCORED			BRICK		LIME		
	Per M. lots of 2,000 pieces or over,			Per M. lots of 2,000 pieces or over,			Per M. in quantity		Per ton,	In paper,	Carload lots,
	3x12x12 in.	4x12x12 in.	8x12x12 in.	8x12x12 in.	10x12x12 in.	12x12x12 in.	Common backing	Straight hard	Hydrated finishing	Common hydrated	Pulverized or lump
Atlanta	$104.00	$114.00	$199.00	$234.00	$244.00	$250.00	$13.50	$18.04	$26.54	$15.04	$15.04
Baltimore	84.00	90.00	170.00	200.00	260.00	320.00	15.90*k*	19.00*k*	18.00	13.00	2.50*m*
Birmingham	80.00	85.00	160.00	191.00	252.00	288.00	14.50	17.00	18.11	13.64	2.25*n*
Boston	89.35*a*	93.30*a*	178.70*a*	202.50	271.80	308.70	16.50*i*	19.50*i*	17.50†	12.50†	14.92†
Chicago	72.00	77.00	145.00	197.00	243.00	278.00	12.50	13.50	17.00	15.00	12.50
Cincinnati	65.55	69.90	131.20	148.70	210.35	240.45	22.00	22.00	15.50	13.00	.....
Cleveland	60.00	64.00	120.00	144.00	193.00	221.00	17.00	17.00	15.75*j*	13.25*j*	3.50*o*
Dallas	62.50	67.50	135.00	162.00	212.50	263.00	13.50*i*	15.00*i*	19.00	15.00	15.00
Denver	84.80	95.40	153.70	178.20	212.00	227.90	14.50	18.00	25.00*j*	17.00*j*	20.00*j*
Detroit	86.05*x*	91.80*x*	172.10*x*	213.00*x*	268.00*x*	311.60*x*	20.00	21.00	18.00	16.00	16.00
Kansas City	67.00	69.00	89.00*c*	128.00	163.00	189.00	14.50	16.50	19.32	13.00	10.92
Los Angeles	73.50†*r*	89.50†*r*	128.00*c*†*r*	210.00†*r*	368.00†*r*	460.00†*r*	13.50	15.00	16.50	17.50	17.50
Minneapolis	81.95*b*	87.40*b*	148.70*b*	.....	179.30*b*	249.35*b*	13.60	15.60*g*	21.00	16.00	19.00
Montreal	94.55*a*	100.45*a*	199.50*a*	160.45*a*	109.40*at*	137.40*av*	21.08†*u*	28.35†*u*	24.60*u*	18.00*u*	.....
New Orleans	72.00	72.00	135.00	162.00	210.00	260.00	14.00	.....	18.30	12.08	14.10
New York	78.40	83.60	115.00*c*	193.30*h*	238.80*h*	295.60*h*	16.50/17.50	.....	20.00	14.00	17.00
Philadelphia	85.30	91.00	170.50	204.60	252.00	312.00	17.00	20.00	19.00	16.00	15.00
Pittsburgh	62.35	66.55	124.75	140.25	173.25	198.00	17.50	19.50	17.90	15.40	2.55*m*
St. Louis	67.00	95.00	130.00	190.00	244.00	290.00	18.00	17.00	22.00	18.00	2.50*m*
San Francisco	96.00	108.00	144.00	.....	.....	.....	19.00	.....	24.00	23.00	2.50*m*
Seattle	115.00	125.00	230.00	.....	.....	.....	20.00*f*	21.00*f*	20.00*s*	20.00*s*	20.00*s*

† F.o.b. *a* Smooth. *b* Carload lots delivered to job. *c* 6x12x12 in. *d* Not load bearing. *e* 48 lb. tile. *f* Less $1.00, ½ cash 15 days, balance 30 days *g* Selected common. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. Warehouse only. *j* LCL ‖*k* $1.00 discount if paid in 10 days. *l* Lump. *m* Per bbl., 180 lb. *o* Per bbl., 200 lb. *p* 280 lb. bag. *r* 5% discount 10 days. *s* 2% discount for cash. *t* 5½x8x12. *u* 8% sales tax included. *v* 6x12x12-in. *w* Per 200 lb bag *x* Prices also apply for Dec. and Jan.; market in Detroit unsettled; Tile scarce.

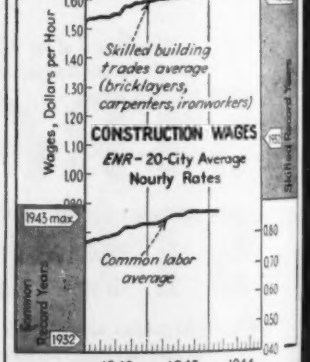
PAINT, ROOFING—F.O.B. CARLOAD LOTS

	RED LEAD	WHITE LEAD	READY-MIXED PAINT			ROOFING SUPPLIES Carload lots f.o.b. factory				
	Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	Per 100 lb. in oil	Per gal., drums Graphite *b*	Aluminum *b*	Ferric Oxide *d*	Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 350 lb. bbl. per ton
Atlanta	$10.25	$14.125	$1.30	$2.25	$1.20	$1.90	$1.61	$1.61	$0.27	$29.00
Baltimore	10.00	13.75	2.00	3.00	2.50	2.30	2.70	2.70	.40	29.00
Birmingham	10.25	14.125	2.35	3.50*r*	1.98*r*	2.04	1.97	1.97	.32	28.35
Boston	10.00	13.75	1.65	....	2.30	2.10‡	1.65*h*‡	1.65*h*‡	.50‡	21.00‡
Chicago	10.00	13.75	....	....	....	1.75*h*/	1.74*h*/	1.82*h*/	.33/	23.00/
Cincinnati	10.00	13.75	1.70	2.90	1.60	2.40	2.39*h*	2.39*h*	.36	21.00
Cleveland	10.00	13.75	1.70	2.90	1.60	1.93	1.83*h*	1.83*h*	.35	29.00
Dallas	10.00	14.50	1.88	2.11*n*	.08*l*	1.75*h*	1.66*h*	1.66*h*	.35	39.00
Denver	10.50	14.25	....	14.25*k*	.27*l*	2.45	2.95	2.95	.35	28.00
Detroit	10.00	13.75	1.75	3.00	1.60	2.25	2.25	2.25	.50	23.00
Kansas City	10.00	13.875	2.30*g*	2.55*gr*	2.16*g*	2.10	2.30	2.30	.28	27.50
Los Angeles	10.25	14.25	1.60	2.25	2.30	2.10	1.50	....	.45	.....
Minneapolis	10.00	13.875	....	....	....	1.75*i*	1.66*h*‡	1.66*h*‡	.32	23.00
Montreal	9.25	6.25	2.50*p*	4.90*p*	3.15*p*	2.67	2.47	2.07	.94	1.85*t*
New York	10.00	13.75	2.03	....*r*	1.64	1.66	1.58*h*	1.58*h*	.26	25.00
Philadelphia	10.00	13.75	1.60/1.80	2.20*r*	1.55	1.75	1.66	1.66	.32	23.00
Pittsburgh	10.00	13.75	1.05	1.95	.80	1.95	1.94*h*	1.94*h*	.34	26.00
St. Louis	10.00	13.75	2.28*s*	2.89*s*	1.96*s*	1.66	1.66	1.66	.28	23.00
San Francisco	10.25	14.00	1.80	2.75*n*	1.35	1.71	2.40	2.40	.33	20.50
Seattle	10.25	14.25	1.90	3.00	....	2.15	2.16*h*	....	.35	26.50‡

‡ Delivered. Note: Red lead in oil 50c. higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price charges. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* Subject to 25% discount. *f* Distributors' price to contractors. *g* 5 gal. can. *h* Per roll, 65 lb. *i* Per lb. *m* Per bbl. *n* May, 1941 price, no later quotation available. *p* 8% sales tax. *r* Not available, except on priority rating; then quoted special *s* December, 1942 price. *t* Per 100 l

SKILLED AND COMMON WAGE RATES—PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Common Labor Building	Common Labor Heavy Const.
Atlanta	$1.50	$1.25	$1.50	$1.25	$1.50	$0.40	$0.50
Baltimore	1.75	1.375	1.80	1.625/1.80	1.50	.75	.75
Birmingham	1.75	1.25	1.50	1.25/1.50	1.50	.65	.65
Boston	1.625	1.50	1.65	1.875	1.667	.80/1.00	.80/1.00
Chicago	1.75	1.70	1.76	1.75	1.825	1.10	1.10
Cincinnati	1.75	1.50	1.675	1.45/1.60	1.625	.85	.85
Cleveland	1.875*c*	1.55	1.75	1.75	1.75	1.00/1.25	1.00/1.25
Dallas	1.625	1.25	1.50	1.75	1.625	.60	.75/1.25
Denver	1.65*b*	1.50*b*	1.50*b*	1.50/1.625*b*	1.65*b*	.80*b*	.80*b*
Detroit	1.675	1.50	1.75	1.625/1.75	1.675	.90	.90
Kansas City	1.65	1.50	1.625	1.625	1.65	.90	.90
Los Angeles	1.50	1.35	1.625	1.375	1.667	.875	.875
Minneapolis	1.50	1.375	1.50	1.40	1.50*e*	.925	.925
New Orleans	1.50	1.25	1.50	1.50	1.375	.65	.75
New York	2.00*b*	1.85*b*	2.00	2.00*b*	2.00*b*	1.031	.95
Philadelphia	1.90	1.50	1.90	2.00	2.00	.825	.825
Pittsburgh	1.90	1.75	1.75	1.8125	1.875	.90	.80
St. Louis	1.75	1.50	1.75	2.00	1.75	.95	.95
San Francisco	1.875	1.50	1.75	1.50/1.75	1.75	.95	.95
Seattle	1.78	1.48	1.68	2.00	1.78	1.08	1.10
Montreal*f*	.92	.81	.90	.76	.90	.46	.53



ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $1.
ENR Common Average: $0.869

b 7 hr. day. *c* Prevailing rate on government work. *e* 35 hr. wk. *f* Effective Nov. 15, 35c weekly bonus added to these rates.

he California Supreme Court has af-rmed its recent decision that owners f property fronting streets closed by he construction of freeways or through ighways are entitled to damages.

Position of the high court in such ases was made clear in its denial of a oint plea from Attorney General Rob-rt W. Kenny and the State Department f Public Works for a rehearing of a ight of way lawsuit in which the plain-iff had been awarded damages against he state.

The damage action was brought by ntonino Ricciardi of Los Angeles for oss of visibility to and from his prop-rty as the result of the construction of major Los Angeles County freeway. le was awarded damages of $15,000 n this cause of action, and an addi-ional $9,000 for property taken from im for street widening.

This decision of the Superior Court as subsequently affirmed in the dis-rict Court of Appeal, and last fall the upreme Court refused to reverse the dgment. The point at issue was the ling of the Los Angeles Superior ourt that abutting property owners possess the right of direct access to the rough traffic highway" of a freeway velopment, an "easement of reason-ble view of their property from such ighway" and that creation of a *cul de* c gives all property owners in a block e right to claim damages.

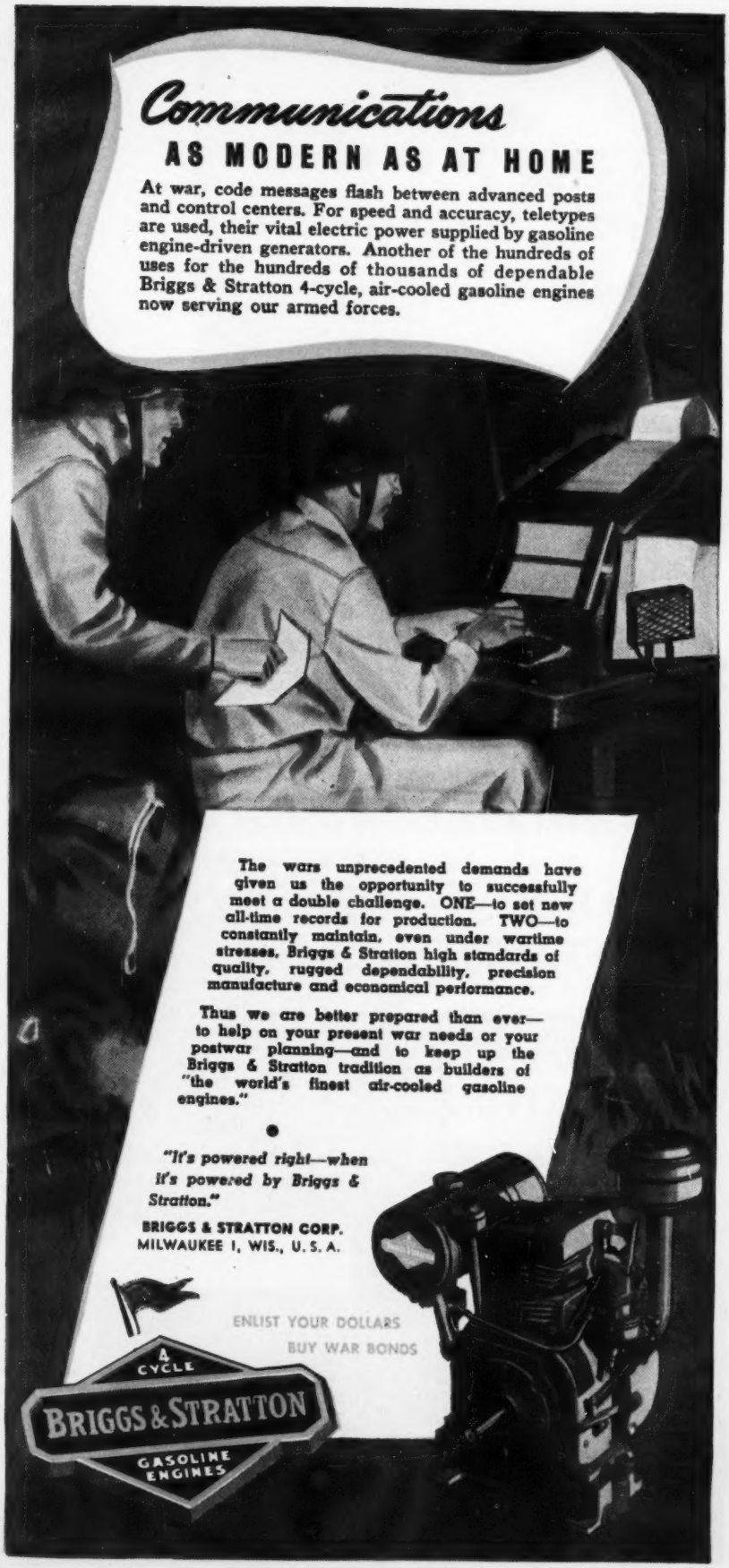
The petition for a rehearing sub-itted by the Attorney General and the epartment of Public Works contended at these and other provisions of the lings has made virtually unlawful, cept upon compensation, such types work as grade separations, highway ngitudinal division strips and free-ays with centrally divided traffic lanes r high speed through traffic, bordered outer roadways for local traffic.

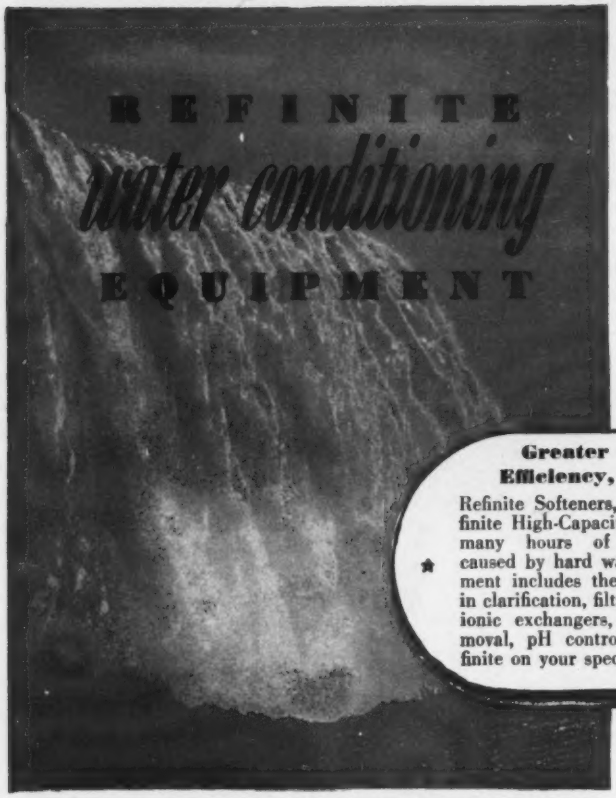
In denying the petition for a rehear-g, the Supreme Court, in the opinion state highway officials, opened the y for any property owners similarly fected to obtain compensation, thus aking the cost of improved highways ohibitive.

• • •

New industrial city being built in Mexico

The first modern industrial center in xico is under construction in the city Ecatepec de Morelos in the state of xico. This rapidly rising new city oins the federal district (Mexico y) not far from the Guadalupe Sanc-ry. Streets and utility services are ng laid out in the first unit of a ject which ultimately will be the gest and most complete industrial


Communications
AS MODERN AS AT HOME
At war, code messages flash between advanced posts and control centers. For speed and accuracy, teletypes are used, their vital electric power supplied by gasoline engine-driven generators. Another of the hundreds of uses for the hundreds of thousands of dependable Briggs & Stratton 4-cycle, air-cooled gasoline engines now serving our armed forces.
The wars unprecedented demands have given us the opportunity to successfully meet a double challenge. ONE—to set new all-time records for production. TWO—to constantly maintain, even under wartime stresses, Briggs & Stratton high standards of quality, rugged dependability, precision manufacture and economical performance.
Thus we are better prepared than ever—to help on your present war needs or your postwar planning—and to keep up the Briggs & Stratton tradition as builders of "the world's finest air-cooled gasoline engines."
"It's powered right—when it's powered by Briggs & Stratton."
BRIGGS & STRATTON CORP.
MILWAUKEE 1, WIS., U. S. A.
ENLIST YOUR DOLLARS
BUY WAR BONDS
4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES



Greater Capacity, Efficiency, Durability

Refinite Softeners, equipped with Refinite High-Capacity Zeolite, will save many hours of production delay caused by hard water. Refinite equipment includes the latest development in clarification, filtration, iron removal, ionic exchangers, condensate oil removal, pH control, etc. Consult Refinite on your special water problems!

THE REFINITE CORPORATION

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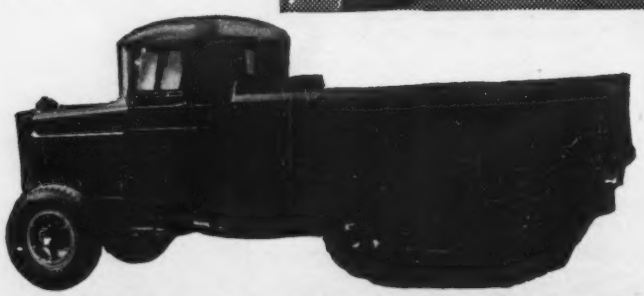
PAN AMERICAN WORLD AIRWAYS

use

LINN HAFTRAKS

to build and maintain their vital airports throughout Central and South America



THE LINN MANUFACTURING CORPORATION
MORRIS, NEW YORK

center in Mexico or Central America.

Creator of the new city is Gov. Isidro Fabela of the State of Mexico. It is part of a definite zoning and planning program including road construction, reforestation and general improvements.

Gov. Fabela is being aided by a group of Mexican financiers, engineers and business men. He has promised tax exemptions to industries settling in the new city. The site is near part of the Pan American highway to Laredo. A new portion of the highway is only a few hundred yards to the west, with cross-roads and bridges to the old road, so that the new industrial city may be reached by both roads.

Engineers consider the location ideal. It has well-drained level lands and plenty of water, spurs to the tracks of the Mexican and National railways and to the narrow-gauge tracks of the Ferrocarril del Desague, by which access will be had to tracks of the other narrow-gauge railroads.

• • •

Flood control plan for Westchester County

The creation of a Westchester County, N. Y., flood control commission to cope with the flash floods that have become increasingly costly there in recent years was recommended Jan. 11 by the Westchester County Village Officials Association. In a ten-page tentative draft, the association suggested that all new construction of bridges, bulkheads, river banks, highways and culverts, as affecting flash floods, should be under the proposed commission's jurisdiction.

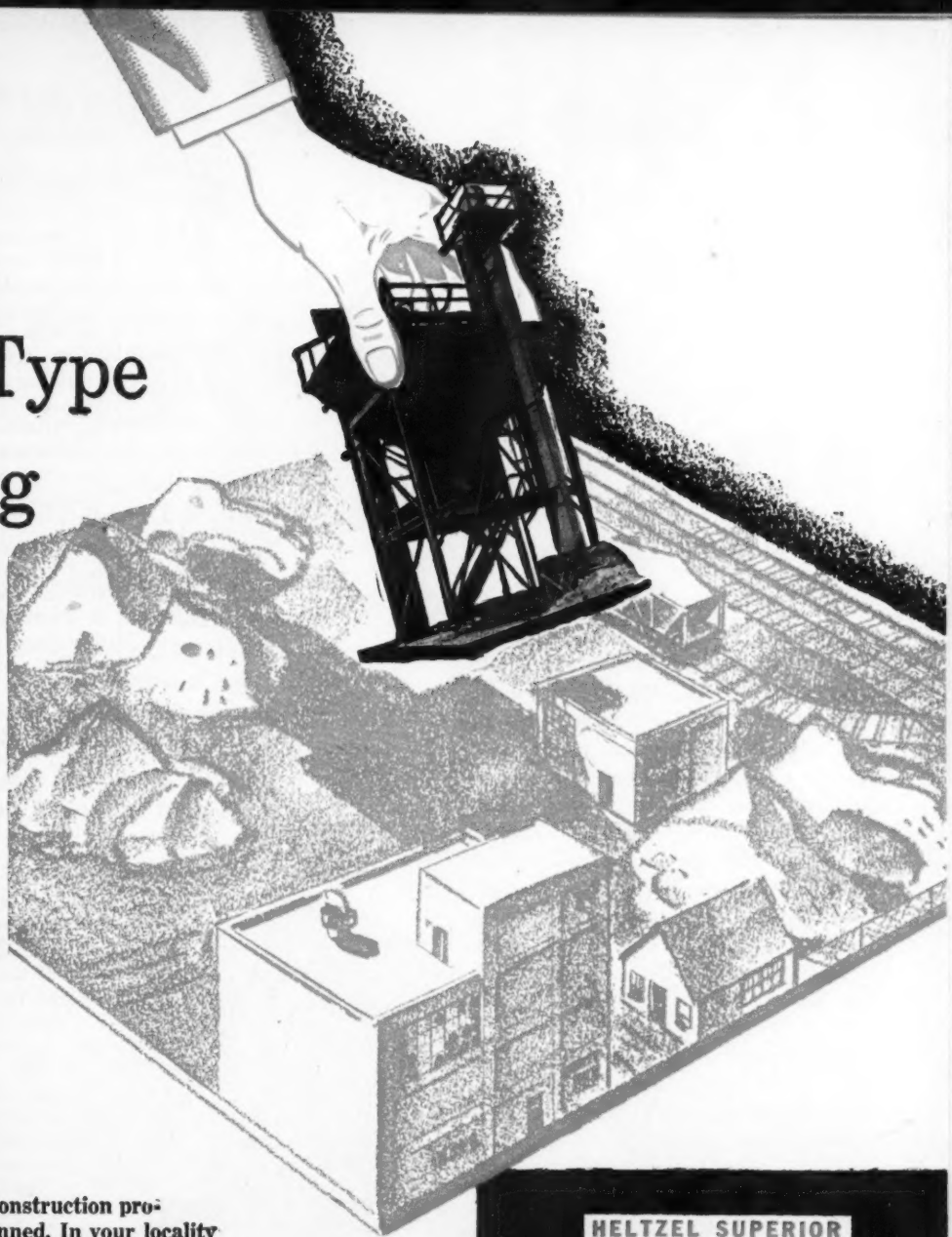
• • •

WPB simplifies rules for equipment purchase

The procedure by which construction contractors can purchase construction equipment for use on civilian projects has been simplified to the extent that they now have only to file application for authorization to the War Production Board to purchase it, whereas formerly they had to make special appeal to WPB. The list of 39 items concerned includes such things as contractors' rotary brooms, portable concrete hoppers, portable type screening plants, self-propelled earth-moving graders, and elevating earth moving graders.

The change is made by amendment of Order L-192 effective Jan. 10. Applications are to be made to the Washington office of WPB. The procedure for getting repair parts also has been simplified. Appeals for these can now be made to the nearest field office of WPB.

What Type Batching Plant Will YOU Require ?



Most post-war concrete construction projects will go forward as planned. In your locality are many thousands of dollars worth of aggregate material and ready-mix concrete business already scheduled.

This business will demand certain changes and increases in your material handling equipment. Changes brought about by stepped-up war time production . . . changes that will be demanded in stepped-up post-war construction.

Is your present bin and batching equipment adequate for your share of this business?

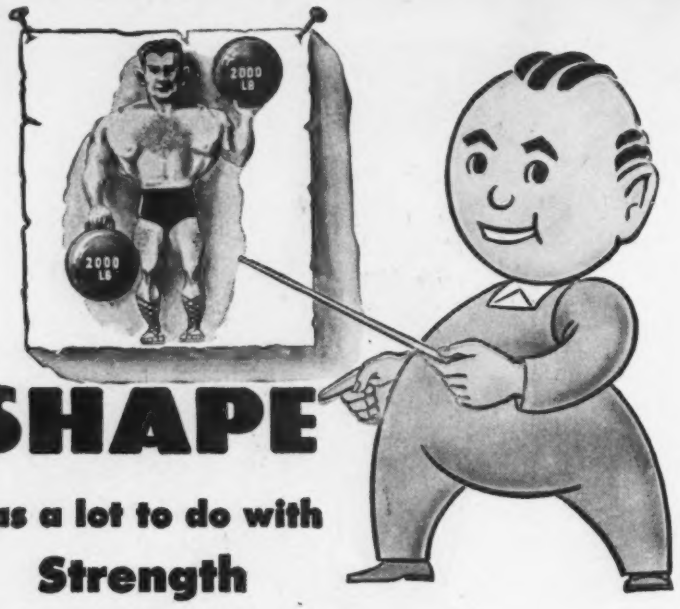
Heltzel catalogs and bulletins on all types of material handling equipment are available. Heltzel engineers are ready to assist in any type of plant layout.

• *INVESTIGATE* •

HELTZEL SUPERIOR CONCRETE CONSTRUCTION EQUIPMENT

- MILITARY HIGHWAY FORMS
- AIRPORT FORMS
- DUAL DUTY AIRPORT FORMS
- CURB, CURB AND GUTTER OR SIDEWALK FORMS
- PORTABLE AGGREGATE BATCHING BINS — 30 TO 100 TONS CAPACITY
- PORTABLE AND SEMI-PORTABLE BULK CEMENT BATCHING BINS FROM 100 TO 750 BARRELS CAPACITY
- CENTRAL MIXING PLANTS
- CEMENT TANKS TO 1500 BARRELS
- TREMIE CHUTING
- CONCRETE FLOOR HOPPERS
- CONCRETE BUCKETS

HELTZEL STEEL FORM & IRON CO.
WARREN, OHIO • U. S. A.



SHAPE

has a lot to do with Strength

Every time you start a load, or shift gears, the engine's torque is applied directly to the transmission. The teeth in the gears must be able to withstand not only extreme pressure, but often a series of shock loads. Naturally, correct gear ratios help, but Fuller has gone further than this. Through design research and test, it was found that sturdier strength could be added to the individual gear teeth by a change in their shape. That's why the teeth in Fuller gears are different from ordinary gears—more resistant to shock and strain. It's another reason why Fuller transmissions have these well recognized characteristics: (1) Quiet running (2) Easy shifting (3) Longer wear life.

FULLER MANUFACTURING CO., KALAMAZOO, MICH.
Transmission Division
Unit Drop Forge Division, Milwaukee, Wisconsin

ERIE

SINGLE STAGE—SIDE SUCTION CENTRIFUGAL PUMPS

TYPE E ENCLOSED IMPELLER

—

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Sizes 1" to 12"

ERIE PUMP & ENGINE WORKS
152 Glenwood Ave., Medina, N. Y.

WILLIAMS *Buckets*

WELDED ROLLED STEEL CONSTRUCTION

All types and capacities for all conditions. Send for Catalog.

THE WELLMAN ENGINEERING COMPANY
7000 Central Avenue
Cleveland, Ohio

built by WELLMAN

MEN AND JOBS

James P. Exum, with 14 years service in the Texas Highway Department, has been appointed its chief bridge engineer, succeeding the late George G. Wickline. Mr. Exum is a native Texan, forty-three years of age. He received his degree in civil engineering at the University of Texas in 1922. He then served two years on design and construction of bridges with the engineering firm of Harrington, Howard and Ash of Kansas City, Mo. He has been connected with the bridge division of the highway department since 1932.

Capt. Spencer J. Buchanan, assistant to the chief of the Engineering Division, and Capt. Howard L. Mullen, area engineer at Barksdale Field, Shreveport, La., have been transferred to other duties.

Appointment of **Albert Grathwol,** as superintendent of the waterworks distribution system, at Sandusky, Ohio, to succeed Charles H. Gremelsbacher, resigned, has been announced. Orlin Voltz, was appointed assistant superintendent.

Claude A. Thompson, district highway maintenance engineer at Mankato, Minn., has been appointed district engineer of the eighth highway district to succeed the late Clair J. Swift. Mr. Thompson has been connected with the state highway department since 1922.

Appointment of **W. A. Thompson, Jr.,** as manager of its petroleum and chemical division has been announced by the construction firm of Barrett & Hilp, San Francisco, Calif. Thompson for the past several years has been associated with E. B. Badger & Sons Co., of Boston, Mass. Prior to that, he had done specialized work for Sun Oil Col., Necaro Co., Inc., Lyons & Slattery

The "Buff" is rarely sold by an owner, for he loves its accurate and smooth operation too dearly.

Rental Transits—Reasonable Rates. Send for handsome new catalog #491.

BUFF & BUFF INSTITUTE
J. P. Boston, Mass.

The BUFF "X" TELESCOPE has the finest and highest definition and simplest lens system. It is useful when the light is dim.

They practice what they preach

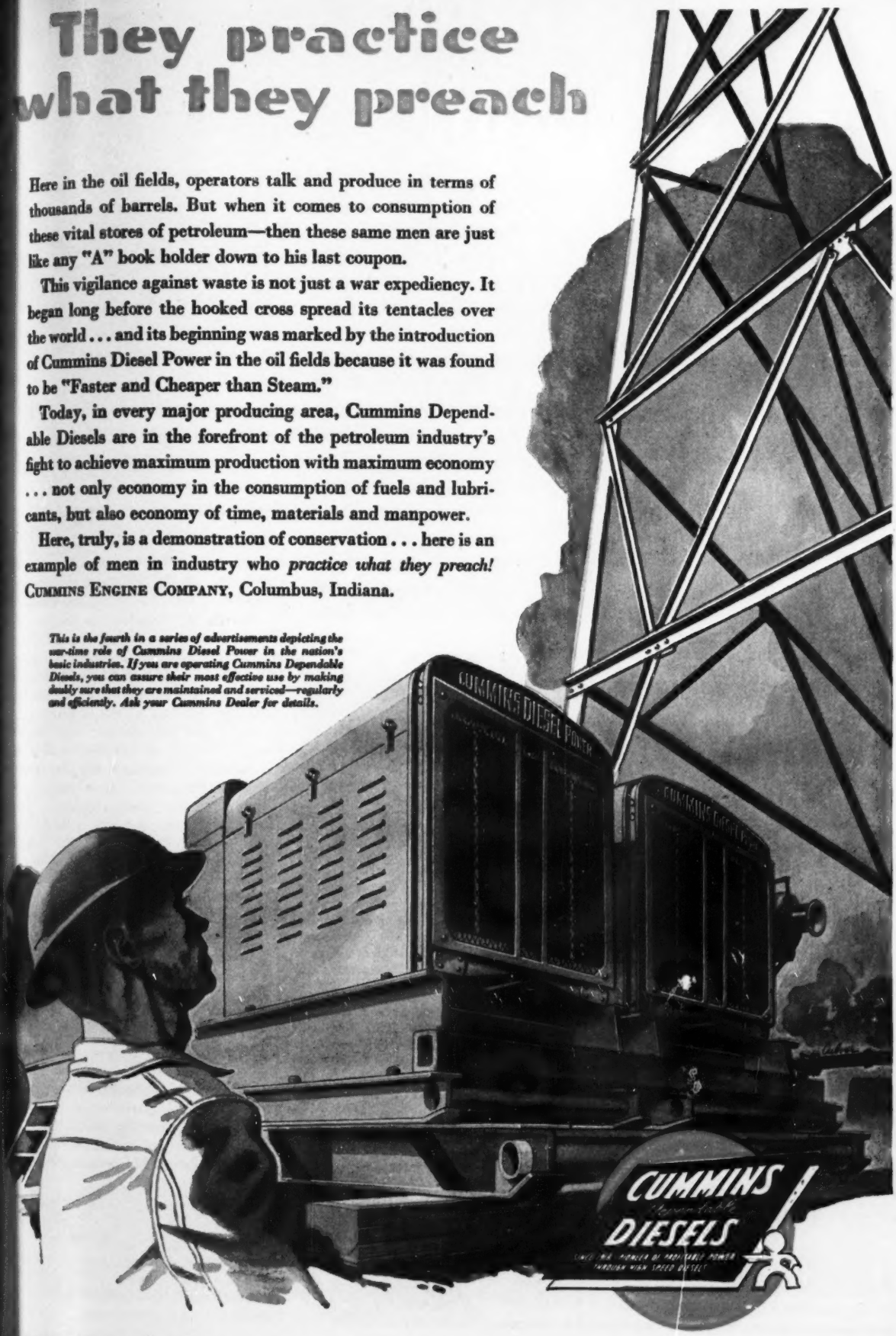
Here in the oil fields, operators talk and produce in terms of thousands of barrels. But when it comes to consumption of these vital stores of petroleum—then these same men are just like any "A" book holder down to his last coupon.

This vigilance against waste is not just a war expediency. It began long before the hooked cross spread its tentacles over the world . . . and its beginning was marked by the introduction of Cummins Diesel Power in the oil fields because it was found to be "Faster and Cheaper than Steam."

Today, in every major producing area, Cummins Dependable Diesels are in the forefront of the petroleum industry's fight to achieve maximum production with maximum economy . . . not only economy in the consumption of fuels and lubricants, but also economy of time, materials and manpower.

Here, truly, is a demonstration of conservation . . . here is an example of men in industry who *practice what they preach!*
CUMMINS ENGINE COMPANY, Columbus, Indiana.

This is the fourth in a series of advertisements depicting the war-time role of Cummins Diesel Power in the nation's basic industries. If you are operating Cummins Dependable Diesels, you can assure their most effective use by making doubly sure that they are maintained and serviced—regularly and efficiently. Ask your Cummins Dealer for details.



QUIMBY ROTEX PUMPS

PULSELESS DISCHARGE

means . . .

LONGER LIFE
LESS MAINTENANCE
STEADY FLOW

ROTEX
CENTRIFUGAL
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CHEMICAL

QUIMBY PUMPS

QUIMBY PUMP COMPANY
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Division of H. K. PORTER COMPANY, Inc.
PITTSBURGH, PENNSYLVANIA
FACTORIES:
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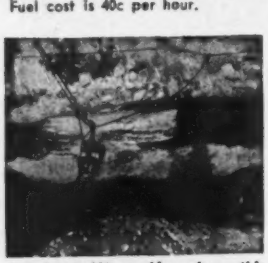
PLAINSVILLE, PA. NEW BRUNSWICK, N.J.

Costs Reduced

Sauerman Scraper hauls sand from hill to feed two asphalt mixing plants. One man runs the machine. Fuel cost is 40c per hour.



In about 100 working days, this 900-ft. span, 1½ cu. yd. Sauerman Slackline Cableway removed 40,000 tons of loose rock impeding a spillway and piled the spoil several hundred feet back from edge of stream.

dig, haul & dump

. . . . for a few cents per yard!

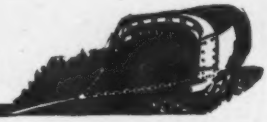
Where materials are to be moved distances of several hundred feet or more, a SAUERMAN Drag Scraper or Cableway can cut the cost per cubic yard to a low figure because it is able to dig, haul and place the material in a continuous, straightline operation, doing away with the expense of rehandling. The operation is smooth and rapid, producing large yardage with moderate expenditure of power.

The first cost of a SAUERMAN Machine is reasonable, maintenance amounts to very little, and the simplicity of operation makes it possible to place the control of even the largest installation in the hands of one operator. Moreover, the machine is very flexible, hence it is easy to adapt it to the exact needs of different jobs.

GET THIS USEFUL BOOKLET . . .

Typical examples of pit and bank excavation, reservoir cleaning, cut-and-fill work, moving blasted ore, deep dredging, stockpiling and reclaiming, etc., are illustrated in the Sauerman catalog. A copy of this booklet is yours for the asking.

SAUERMAN BROS, Inc.
532 S. CLINTON ST. CHICAGO 7, ILLINOIS



Co., Inc., and the New York Central Railroad, and had headed his own firm, the Thompson Engineering & Contracting Co., Inc., in New York City.

Col. E. Raban Vince has been named town engineer and manager of Woodstock, N. B., succeeding Beo. B. Kilpatrick. Col. Vince retired recently from the Royal Canadian Engineers after 37 years of service.

Col. Sam Strickland, High Point, N. C., city engineer on leave, recently completed a course at an Army School of Military Government after seeing service with the Corps of Engineer at Fort Moultrie, S. C., Fort Screven, Ga., and in Trinidad.

William Aldridge has been appointed city engineer of Winnipeg, Man. Mr. Aldridge succeeds W. P. Brereton.

C. F. Churchill, representative of the Federal Works Agency of Richmond, Va., is supervising engineer in charge of the construction of new water supply facilities at Wilmington, N. C. William C. Olsen of Raleigh, N. C., is consulting engineer for the FWA, on the project.

Orville W. Crowley has resigned as executive secretary of the Central Branch, Associated General Contractors of America, at Des Moines, Ia., after 23 years. During that time he built the chapter into one of the largest A.G.C. groups. For the past two years he has been on leave of absence to serve as construction manager for the Lytle-Green Construction Co. on the northern section of the Alaska Highway. This contractor was recently awarded the maintenance contract for the Alaska sector of the road, and Mr. Crowley has returned to take charge, taking his family with him.

William H. Day, city engineer of Rockford, Ill., is now serving in the armed forces as a 1st Lieutenant with the Army Engineers at Fort Screven, Ga.

Frank O. Lee resigned his position as Director of Public Works of the City of St. Petersburg, Fla., in order to enter into partnership with **Paul Jorgenson,** formerly assistant city engineer of the same city, in the organization of a consulting engineering office.

C. W. Mengel, formerly with the City of Greensboro, N. C., is a supervising engineer for the W. C. Olsen Co. of Raleigh, N. C., on the construction of a 9-mile pipeline to a new intake for the municipal water supply of Wilmington, N. C.

...ving Strength to a "Broncho"... Making a Bridge Stand Still

...hat bulldozer, butting dirt and ...s with an impact that shakes ...teeth of the driver . . . needs ...y of guts in the bolts and nuts ... fasten its joints.

...hat bridge is taking punish...t, too, though the effect is not ...vious. It, too, needs bolts and ... so accurately matched they ...d up construction work.

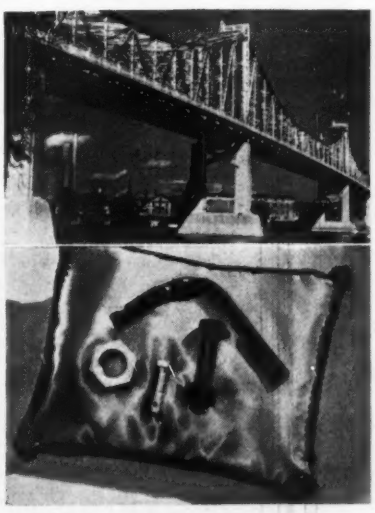
...r strength that survives the ...t licking a tractor or train or ...le can dish out . . . for accurate ...ng that saves precious assem... time: assemble with RB&W ... and nuts.

...r 99 years, RB&W has pio...ed in better, stronger fasteners.

From 1850, when it designed and built the world's first cold header, until 1944, when its great batteries of modern equipment still represent the latest achievement in bolt and nut making history, there has been no slackening in effort to improve its product.

During the past generation, hundreds of thousands of dollars have been spent by RB&W in experimental and research work on nuts alone.

This is only one reason why so many great names in industry have come to depend upon RB&W for fasteners that make their products stronger, faster, better.

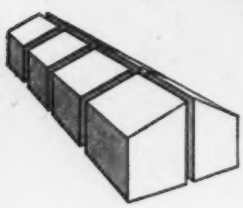


RB&W *Making strong the things that make America strong*

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

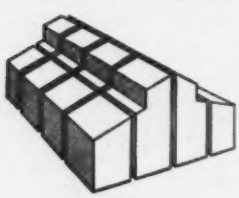
...ries at: Port Chester, N. Y., Coraopolis, Pa., Rock Falls, Ill. *Sales offices at:* Philadelphia, Detroit, Chicago, Chattanooga, Los Angeles, Portland, Seattle

Sectional Ships For WAR
Sectional Buildings For PEACE



"PACKAGED" FACTORIES

Postwar factories will be built from pre-fabricated steel panel sections for speedy erection, even with unskilled labor. They will be durable and firesafe.



"PACKAGED" WAREHOUSES

Postwar warehouses will be constructed of pre-fabricated steel panel sections, and can be easily disassembled for removal to new locations with 100% salvage.

MANY of the famed LST ships which have played so vital a part in American troop invasions have been assembled in shipyards from pre-fabricated steel sections made by International.

This is another example of how the urgency of war compels construction improvements which will affect the future. Already our engineers are using their newly acquired experience to design pre-fabricated steel sections for quick assembly of postwar industrial buildings. "Buildings in packages" for every industrial purpose will be the practice at International Steel Company after the war.

Learn more about this postwar method of steel construction. Write for our lastest literature—now.

International STEEL CO.

★STRUCTURAL STEEL
★STEEL BUILDINGS
★STEEL TRUSSES
★BUILDING PRODUCTS

Evansville 7, Indiana

Fire-Fighting Truck

Utilizing the latest develop hydraulics, a new fire-fighting tr been designed to smother flames ord time. In actual use the

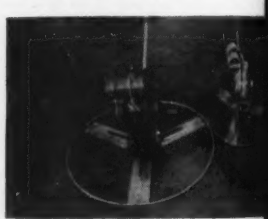
mounted on a truck, delivers wat its 1,000-gal. tank at the rate gpm., at extremely high pressur pressure produces a dense fog, buted through turret guns, whic ply blasts away the flames and it is claimed.

The Hercules split-shaft powe off, installed in the truck's drive transmits the full power of the motor to the pumps, thus saving and weight.—*Hercules Steel Pr Co., Galion, Ohio.*

• • •

Floor Finisher

Lighter in weight than previou els, the new Model J floor finish



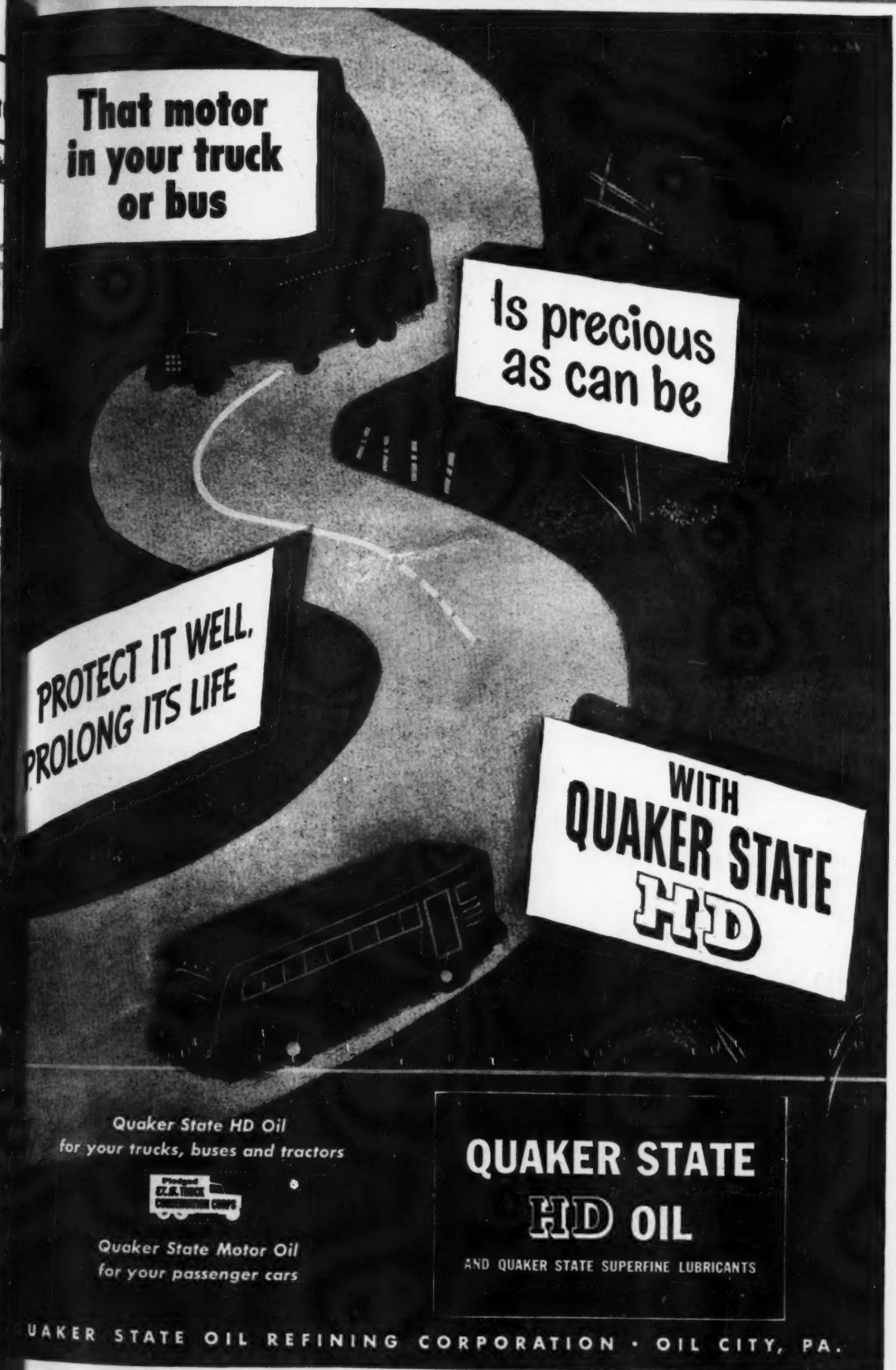
announced by the manufacture in. in diameter, and weighs 100 l

This floor-finishing machine i ered by a Briggs-Stratton m *Whiteman Manufacturing Co., Casitas Ave., Los Angeles 26, C*

• • •

All-Weather AC Welde

Special moisture-proof in throughout has been added to s AC welders in the new "Bum all-weather models, of 300 and 2 pere capacities. In the new w parts are protected by a heavy of moisture-proof paint. The ou finished in durable, weather-r enamel, has gaskets and lou



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for your trucks, buses and tractors

Produced U.S. Truck Conservation Corps

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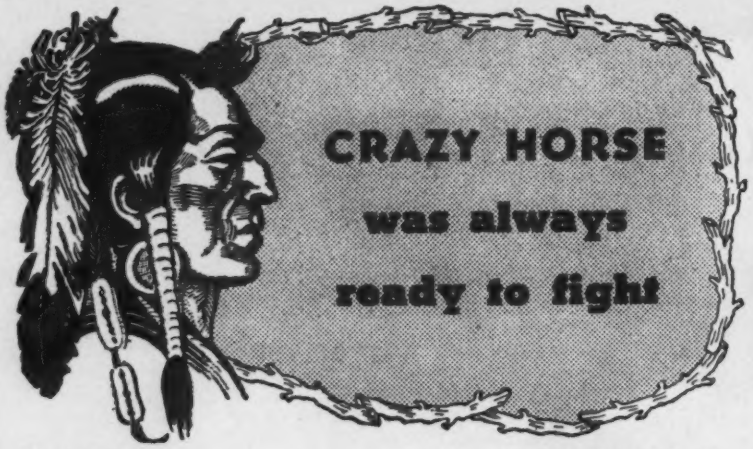

So is the

INDIAN FIRE PUMP

always ready to fight FIRES!

Hot tempered Sioux chief, Crazy Horse gave the white man plenty of trouble until he and his followers were beaten at the battle of Wolf Mountain, Jan. 7th, 1877

Protect your investment in construction jobs and materials with INDIAN FIRE PUMPS, the clear water extinguishers which stop *inside* and *outside* fires fast. 5 gal. tank carries slung on back—easy pumping throws 30 to 50 ft. pressure stream. Order your *INDIAN FIRE PUMPS* now! Strongly built, they last for years. Thousands in use. Write for catalog giving full information and copies of testimonials.

D. B. SMITH & CO.
418 Main St. Utica, N. Y.

Pacific Coast Branch
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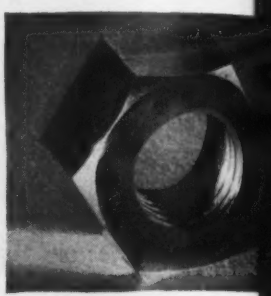
signed to prevent entrance of

This all-weather welder is with a low-voltage contactor tomatically holds the open cir age at approximately 40 volt the operator strikes the arc, voltage contactor closes instant the arc is extinguished, this d mediately reduces the voltage 40 volts.—*Manufactured by Welder and Metals Co., Inc.*, 42nd St., New York, 17, N. Y. tributed by *Air Reduction Sal*

• • •

Vibration-Resistant

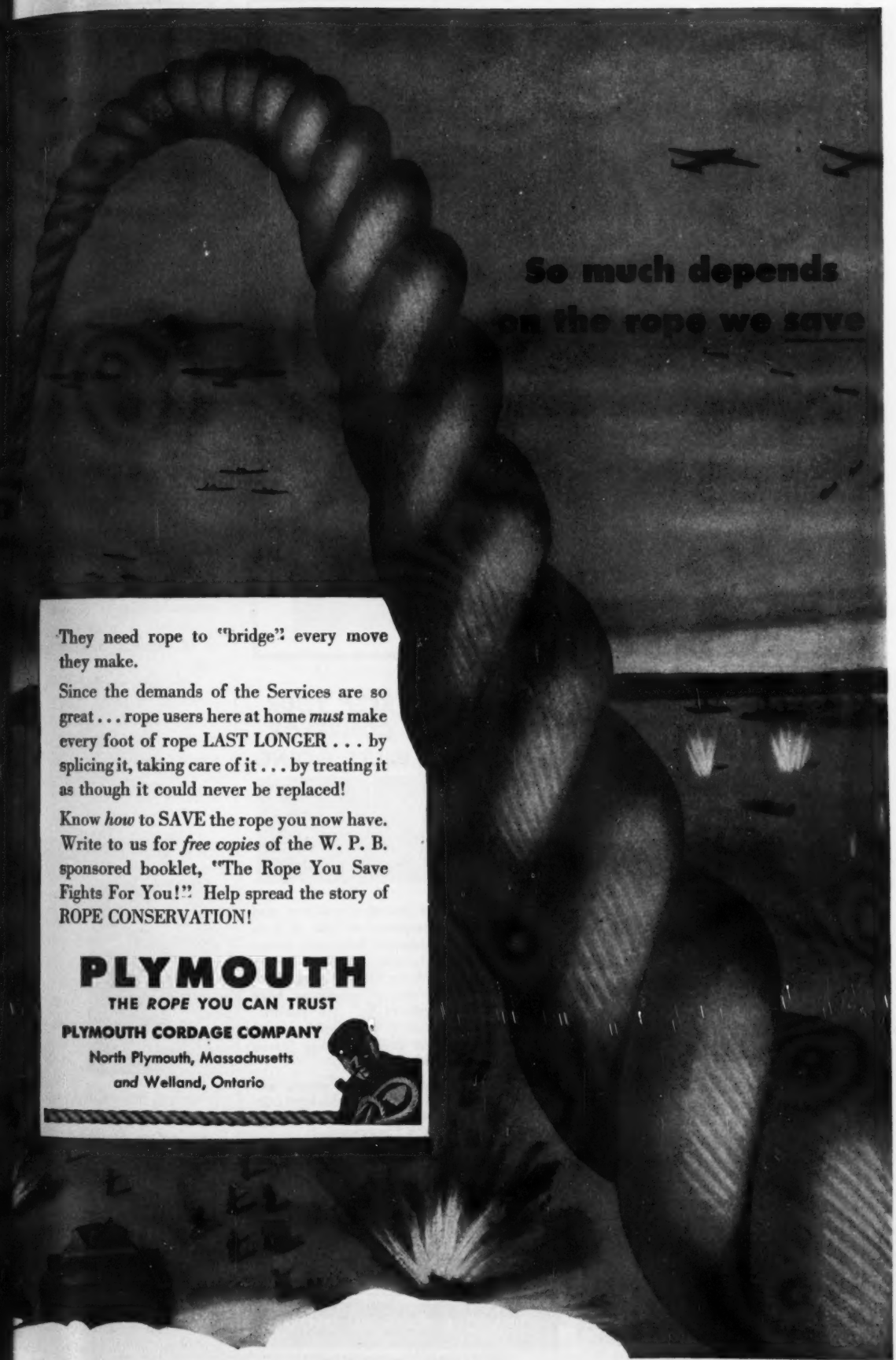
With a gripping action to from loosening under vibratio stop nut utilizes the inherent of the steel in its walls for this The top of the nut, compressed a taper-threaded, hardened st



drel produces this gripping a makes the threaded section of elliptical and leaves the botto

The stop nuts, similar in app to common nuts, have tolera prescribed for Class 3 fit. No or other parts are needed. It is that the nut can be used re without lessening the grip or d the threads. Available in bot Standard and S.A.E. thread, fro 1½ in. bolt size, these nuts ha steel, alloy steel, brass or pla ishes.—*Stover Lock Nut & M Corp., Bushkill Dr., Easton, Pa.*

THE OWEN BUCKET CO.
6010 Breakwater Avenue Cleveland, Ohio
Branches: New York, Chicago, Philadelphia, Berkeley, Cal.



They need rope to "bridge" every move they make.

Since the demands of the Services are so great . . . rope users here at home *must* make every foot of rope LAST LONGER . . . by splicing it, taking care of it . . . by treating it as though it could never be replaced!

Know *how* to SAVE the rope you now have. Write to us for *free copies* of the W. P. B. sponsored booklet, "The Rope You Save Fights For You!" Help spread the story of ROPE CONSERVATION!

PLYMOUTH

THE *ROPE* YOU CAN TRUST

PLYMOUTH CORDAGE COMPANY

North Plymouth, Massachusetts
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AT WAR'S END

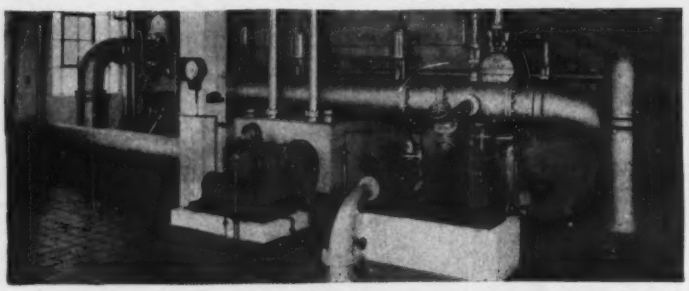
At war's end replace substitute pipe with time-tested Centrifugal Mono-Cast Pipe. Manufactured according to the recently adopted ASA Law of Design or other specifications.

Plan now to insure a quick start on needed improvements and conversions immediately the war ends.

AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM, ALABAMA

Sales offices in Chicago, Cleveland, Dallas, Houston, Kansas City, Los Angeles, Minneapolis, New York, San Francisco



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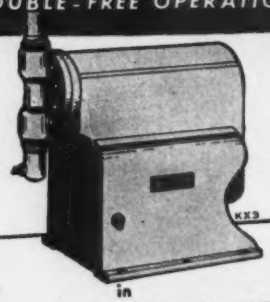

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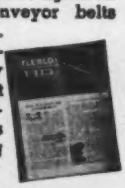
KEEP YOUR CONVEYOR BELTS GOING

FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

● Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.

FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.



FLEXIBLE STEEL LACING CO.
4656 Lexington St., Chicago

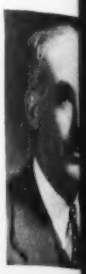
Write for your copy.

FLEXCO HD BELT FASTENERS

Sold by supply houses everywhere

MANUFACTURE ACTIVITIES

THE DEVELOPMENT of synthe lac was announced in Cambridge, on Dec. 2 by the Arthur D. Little laboratories. The new product will help relieve the shortage of natural shellac. C. G. Harford, the inventor, stated that extensive practical experience reveals the new shellac as essentially a duplicate of the product, but surpassing it in some erties, such as adhesion to metal as wood, and resistance to water synthetic shellac is made from av domestic materials. Mr. Harfo viously developed processes f manufacture of one of these ra terials, the corn protein zein, a developed a number of new p in his special field of protective ings.



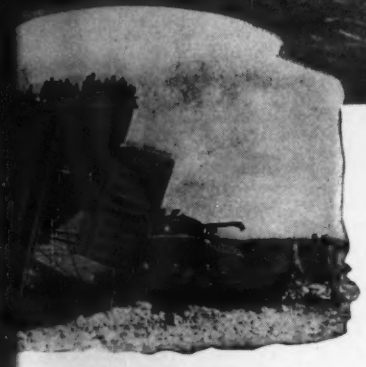
The new shellac is being ma tured by William Zinsser and Co York, and is available for es wartime applications. It is bein now in shipbuilding, life rafts, c nications, gas masks, fuses and military products.

FRUEHAUF TRAILER CO., ann the appointment of Ralph G. Cau director of chases. Mr. ley becom sociated Fruehauf af years with t public Steel where he w sistant manager troit. Prev he was w Wheeling Steel Corp. He was a manager in Detroit for the Wh Corp. when he joined Republic His entire business career has spent in contact with automotive facturers. He was born in Ports Ohio, and attended Marietta Col

W. G. MARSHALL, vice-president dustrial relations at the Westing Electric & Mfg. Company, ha nounced the appointment of C. A as assistant to Thomas L. Phillip president of the East Pittsburgh

It's an L·S·T··· INVASION BOUND!

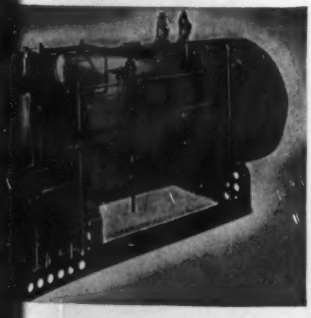
Official U. S. Navy Photograph



Navy Photograph

BEACH-HEAD ESTABLISHED! *Tanks Ashore!*

Cleaver-Brooks steam generator of the type used aboard LST's—for heating the ship—providing steam and hot water for the galley and hygienic needs of the crew and military personnel.



ONE of the most effective and startling types of ships the war has produced is the LST—Landing Ship-Tank.

Born of American ingenuity, these formidable and sea-worthy craft carry American fighting men, supplies, tanks, half-tracks and other mechanized equipment to enemy shores in all corners of the world—Attu, Rendova, Sicily, Kiska, Munda, New Guinea.

Conceived wholly for transport and combat, every inch of space aboard an LST is put to use. These ships cruise from tropic to frigid seas—where ample ship-heating facilities are indispensable. Because Cleaver-Brooks steam generators are exceedingly compact and highly efficient in use of fuel-oil, they are in service aboard LST's—providing necessary steam for heating as well as hot water for the galley and hygienic needs of the men on board. Factory "packaged," finished and tested in every detail—compact, space-saving design—high fuel-to-steam efficiency—quick steaming capacity—dependable 'round the clock performance—these advantages of Cleaver-Brooks steam generators *qualify* them for "combat" duty. Other Cleaver-Brooks equipment in action with our armed forces include portable water distilling units, sterilizers, disinfectors, tank-car heaters, bituminous boosters, and steam generators installed at bases at home and abroad.

Whatever your present or future need for efficient heat generating and utilizing machines—steam generators, steam processing equipment, automatic steam plants, tank-car heaters, bituminous boosters—write us now for complete information in anticipation of the time when normal conditions return.

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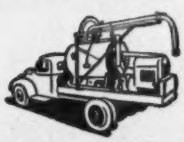
Food Processing Equipment

Tank Car Heaters



Bituminous Boosters

Special Military Equipment

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THE SMITH COMPRESSOR FEATURES

and you'll put these famous compressors to work for you

LOW initial cost, operating cost and maintenance. (60 cu. ft. size illustrated uses ONLY 1 GAL. OF GASOLINE AN HOUR.)

Lightweight, flexible — move them easily from one job to another. SAVES TIME!

Capacity easily varied for different jobs. All the power you'll need for a majority of compressor work.

Made with Ford Motors, standard parts and the patented Smith Compressor Heads. Repairs and parts available everywhere.

Automatic unloading and idling; self-starter.

No couplings, belts, clutches or gears to cause trouble.

Ruggedness and efficiency proved in use the country over.

Wire, phone or write for complete information

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sions. Mr. Smith who has been with the company for 51 years, was manager of factory service at the East Pittsburgh plant. In his new capacity, he will assist Mr. Phillips in the administration and coordination of manufacturing activities. Joining Westinghouse in 1892 as an apprentice Mr. Smith has since that time served as assistant foreman, general foreman, assistant superintendent, superintendent and division manager.

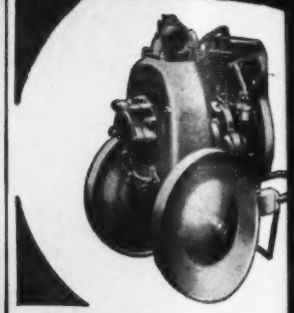
J. F. BECHTLE has joined the Standard Steel Corp., Los Angeles, as assistant general manager. He brings wide experience gained through a 20-year association with the M. W. Kellogg Co. in New York City. He was connected with the metallurgical and research department in the development of welding and pluramelt. He attended Columbia University, studying mechanical engineering.

THE APPOINTMENT of D. A. Bunce as superintendent of the Mansfield, Mass., plant of Hercules Powder Co. is announced. Mr. Bunce, who has been at the Hercules-operated Volunteer Ordnance Works for the past year and a half, joined Hercules in 1936 when the company purchased the Providence Dry Salters Co.

Whereas formerly only $500 worth of materials for minor construction projects necessary in the wartime operation of railroads and other transportation systems could be purchased automatically by applying to the war production board under preference rating order P-142, the figure has now been raised to $2,500. Materials in excess of $2,500 in value may be withdrawn from inventory after the project has been authorized, with such replacements obtainable by using the ratings assigned to the project, which currently are AA-3.

A PROGRAM to stimulate workers to increased effort has been developed by Foote Bros. Gear and Machine Corp. of Chicago. Part of this program includes shop posters telling how Foote Bros.' products are serving the Army and Navy. Recently Rear Admiral E. L. Cochrane, USN Bureau of Ships, sent a telegram to the men and women of Foote Bros. notifying them of the active part the gears they are making are playing in naval action. The telegram was used as a part of the poster campaign to inspire Foote Bros. employees.

JAEGER "SURE PRI



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their promises

with up to 5 times faster priming
hi-head, hi-capacity performance
thousands of extra ho
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Self-cleaning desig
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Every unit individually
and certified—you
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Sizes 3000 to over 200,000 G.

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Controlled FRICTION and LONG WEAR

GATKE Brake Blocks and Frictions — Moulded, to machined accuracy in ALL shapes and sizes —

GATKE MAKES
Brake Lining
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FOR smooth, positive grabbing action for S
Swinging, Hoisting and
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Resisting Asbestos
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They are specially en
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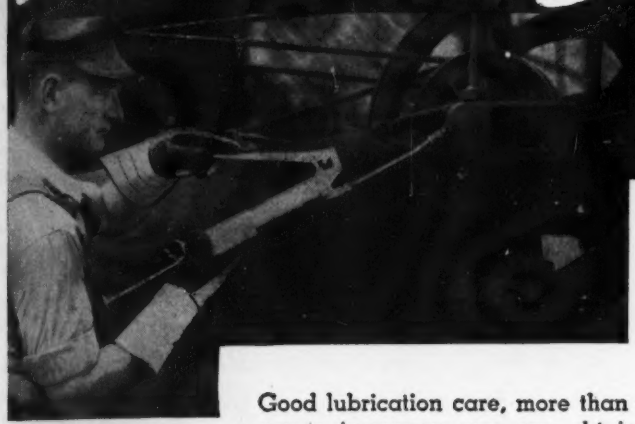
236 N. LaSalle St., Chicago

WATCH Your Lubrication!



Your present excavating equipment will probably have to last for the duration. Under pressure for more and more output in its vital service on the production front, it is operating at top capacity, — very likely three shifts per day.

Good lubrication care, more than anything else, is the most effective maintenance insurance you can obtain. Proper lubrication will extend the life of your excavator, it will avoid breakdowns, will reduce cost of operation and increase output by reducing delays.

To keep your equipment in fighting condition, do these things:

Lubricate each part regularly and thoroughly as prescribed by your manufacturer's operating instructions.

Use the **right amount** of lubricant. Too much can sometimes be harmful.

Use the **right lubricant** as specified for each fitting and part. A good lubricant when applied in the wrong place may be more harmful than none at all.

Use only **good quality** lubricants. "Cheap" oils and greases are dangerous to the machine.

KEEP LUBRICANTS CLEAN

BUCYRUS ERIE

A good operator takes pride in his machine. He keeps it clean and trim and properly lubricated always. It pays off in smooth, continuous performance, maximum production, and long operating life.

HERE ARE A FEW SPECIAL POINTS TO WATCH

1. Ropes and drums should be lubricated regularly. Apply a thin layer often to avoid splatter in operation

2. Be sure to lubricate the suspension ropes. They are likely to rust their strength away if you don't.

3. Lubricate cats even if machine is not propelled much, as normal digging reactions cause some wear

4. Keep the proper amount as well as the correct grade of oil in your gear enclosures at all times.

ARMY E NAVY

Bucyrus-Erie

SOUTH MILWAUKEE, WISCONSIN, U. S. A.

When THE HEAT IS ON!

The real test of men or machines is how they react under pressure—the demand for extra effort—longer hours—harder work.

Take the friction materials used in Twin Disc Power Take-offs or the Model E Heavy Duty Clutches for example. Some materials just can't take it "when the heat is on" . . . the necessary frictional heat which is generated as the clutch is engaged—and the materials disintegrate quickly. That's why Twin Disc developed their own testing equipment to really "put the heat on" various friction materials. The result was the perfection of friction discs which are highly resistant to failure "when the heat is on." At the same time the materials selected must assure a clutch which will take hold smoothly without grabbing—grip firmly and surely without slipping when fully engaged.

More than a quarter of a century devoted to perfecting clutch details, like this, assure the reliable performance and longer work-life of Twin Disc Clutches. This specialized experience has given the Twin Disc Clutch Company a fund of information which is yours for the asking when you have any problem requiring a link between driving and driven units. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Illinois).

Left: Power Take-off. Single or two-plate toggle-action clutches. • Right: Twin Disc Model E Clutch, built to stand heavy shock loads under the most exacting service.

Historical Booklet—A 32-page booklet commemorates the founding of a well known metal company seventy-five years ago and the inventive genius of its founder, Longley Lewis Sagendorph. The history of the company is traced from its inception in 1869 and interwoven are the significant industrial and political events down through the years. Seven pages are devoted to a list of patents taken out by the founder from 1879 to 1907.—*Penn Metal Co., Inc., 40 Central St., Boston, Mass.*

Calcium Chloride—A new folder on the many uses of calcium chloride, in non-technical language describes how calcium chloride may be used for: concrete, fire protection, ending dust and weeds, thawing and skid-proofing ice, drying air and gases, refrigeration brine, weighting tractor tires with non-freeze solution, dust-proofing and freeze-proofing coal and coke.—*Solvay Sales Corp., 40 Rector Street, New York 6, N. Y.*

Grinder Service—A complete line of surface grinding equipment, accessories and supplies is pictured and described in a 20-page booklet, which shows the importance of unity when extreme accuracies and fine finishes are to be achieved in surface grinding operations.

Also shown are the production methods used in the manufacture of these surface grinders and a brief description of the precision gage blocks and instruments manufactured by this company.—*Savage Tool Co., Minneapolis, Minn.*

BELMONT IRON WORKS

PHILADELPHIA ROYERSFORD EDDYSTONE

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STRUCTURAL STEEL
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Multiple span, continuous slab concrete highway bridge west of Topeka, Kansas. Designed by Kansas State Bridge Department. Built in 1941.

Continuous

CONCRETE BRIDGES

combine structural efficiency with economy and pleasing appearance

The structural and economic advantages of continuity have been demonstrated in scores of concrete bridges, large and small, built before the war.

First cost and annual maintenance are reduced.

Fewer joints to be maintained.

Because interior spans may be 30 to 40% longer than end spans, piers can be nearer stream banks; main channel or roadway for grade separation may be wider.

Piers may be narrower because only single bearings are required. This reduces substructure cost and channel obstructions.

Shallower decks are possible because of more efficient distribution of material, thereby reducing dead load and cost.

In many states, design work on continuous concrete bridges for construction after V-Day has been simplified by time-saving design procedure.

Write for revised *"Continuous Concrete Bridges,"* which explains newest time-saving design procedure, tables and diagrams. Mailed free in United States and Canada.

BUY MORE WAR BONDS

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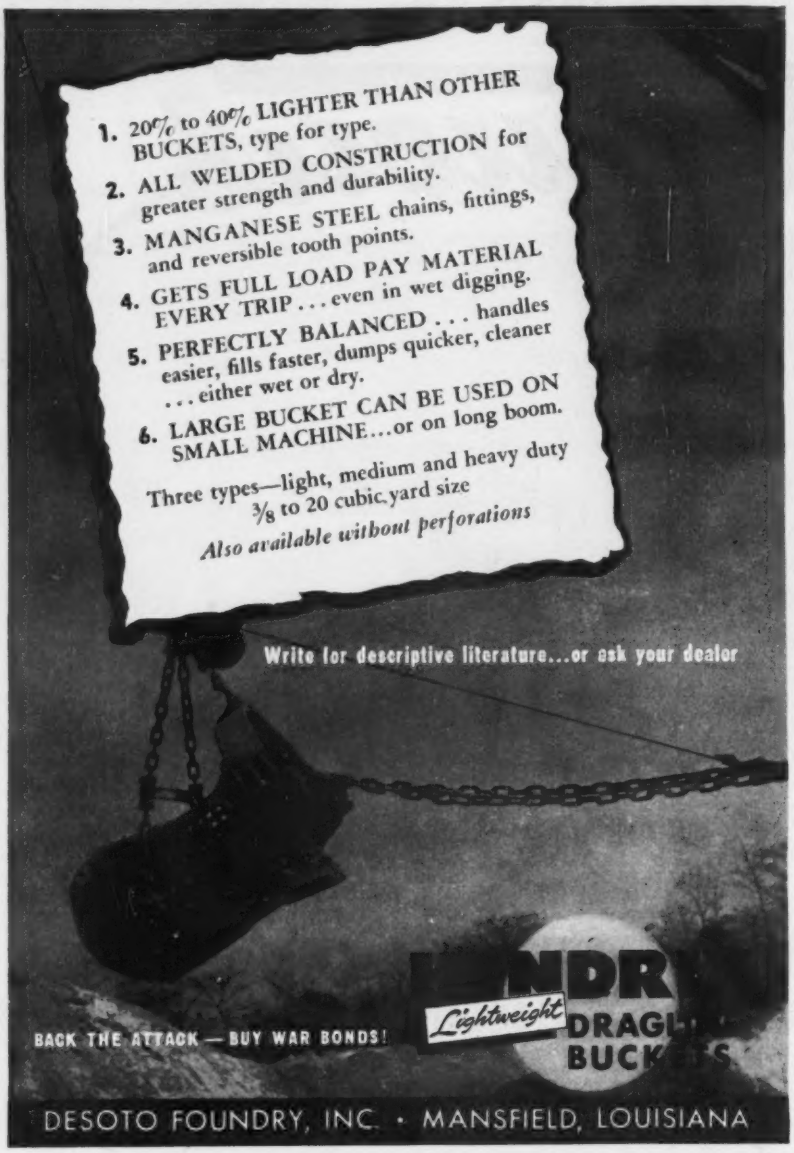
A national organization to improve and extend the uses of concrete... through scientific research and engineering field work

Get a load of these features...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2. ALL WELDED CONSTRUCTION for greater strength and durability.
3. MANGANESE STEEL chains, fittings, and reversible tooth points.
4. GETS FULL LOAD PAY MATERIAL EVERY TRIP . . . even in wet digging.
5. PERFECTLY BALANCED . . . handles easier, fills faster, dumps quicker, cleaner . . . either wet or dry.
6. LARGE BUCKET CAN BE USED ON SMALL MACHINE . . . or on long boom.
Three types—light, medium and heavy duty
3/8 to 20 cubic yard size
Also available without perforations
Write for descriptive literature...or ask your dealer
Lightweight
BACK THE ATTACK — BUY WAR BONDS!
DESOTO FOUNDRY, INC. • MANSFIELD, LOUISIANA

MEETINGS

AMERICAN SOCIETY FOR TESTING MATERIALS, spring meeting and committee week, Netherland Plaza Hotel, Cincinnati, Ohio, Feb. 28-March 3.

AMERICAN CONCRETE INSTITUTE, 40th annual convention, Palmer House, Chicago, Ill., Feb. 29-March 2.

NATIONAL CONFERENCE ON POSTWAR HOUSING, Drake Hotel, Chicago, Ill., Mar. 8-10.

AMERICAN RAILWAY ENGINEERING ASSOCIATION, 44th annual meeting, Palmer House, Chicago, March 14-16.

AMERICAN WOOD PRESERVERS ASSOCIATION, annual meeting, Palmer House, Chicago, Ill., April 26.

REGIONAL AND LOCAL MEETINGS

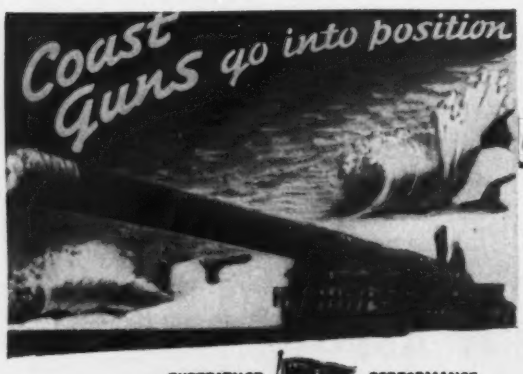
WYOMING ENGINEERING SOCIETY, 25th annual meeting, in joint conference with the Wyoming Postwar Planning Committee, Capitol Building, Cheyenne, Wyo., Feb. 11-12.

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES, 20th annual meeting, Hotel Pennsylvania, New York, N. Y., Feb. 17-18.

IOWA ENGINEERING SOCIETY, 55th annual convention, Hotel Ft. Des Moines, Des Moines, Iowa, Feb. 23-24.

ILLINOIS STATE ASPHALT CONFERENCE, Hotel Abraham Lincoln, Springfield, Ill., Feb. 23-24.

ONTARIO GOOD ROADS ASSOCIATION, annual convention, Royal York Hotel, Tor-



SAFE from Invasion is no idle boast today. The enemy has been driven from the Alaskan outposts and they dare not attack us here!
ROGERS TRAILERS have played a big part in fortifying our coastlines and they are fighting with our men overseas!

on ROGERS TRAILERS

The ROGERS TRAILERS which will be available to industry when present war contracts are completed, will be even better-engineered and more efficient than the thousands which have been operated so successfully for many years.

ROGERS BROS. CORPORATION
ALBION,
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EXPERIENCE builds 'em PERFORMANCE sells 'em

TODAY....

and TOMORROW

● Now's the time to make plans for your pipelines of tomorrow . . . and to get down in black and white all those war-deferred municipal improvements and extensions which can be started immediately after the war.

In planning water supply lines, it's the duty of every responsible official to build the sturdiest pressure lines possible. And, the one sure way to do that is to specify Lock Joint Reinforced Concrete Pressure Pipe. For many years, Lock Joint Pipe has been checked and double-checked, proven again and again, even under the most difficult conditions, a safe and sound investment. When installing Reinforced Concrete Pressure Pipelines, here's the performance you can depend upon: LOW FIRST COST . . . LONG LIFE . . . HIGH CAPACITY . . . LOW MAINTENANCE . . . GREAT STRENGTH . . . WATER TIGHTNESS . . . SAFETY.

The extensive use of Lock Joint Concrete Pressure Pipe for important mains in principal cities throughout the country and the constantly growing number of repeat orders is abundant proof of the quality of these tailor-made pipelines.

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Whether your project is large or small, for the present or the future, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

LOCK JOINT PIPE COMPANY

Established 1905

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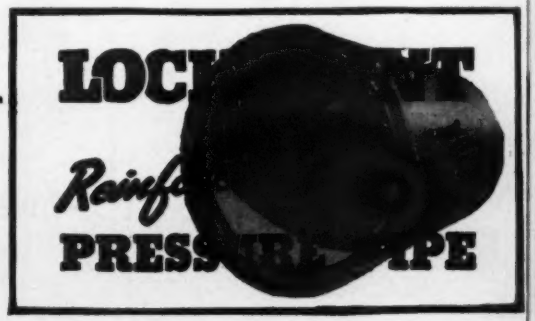
Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*



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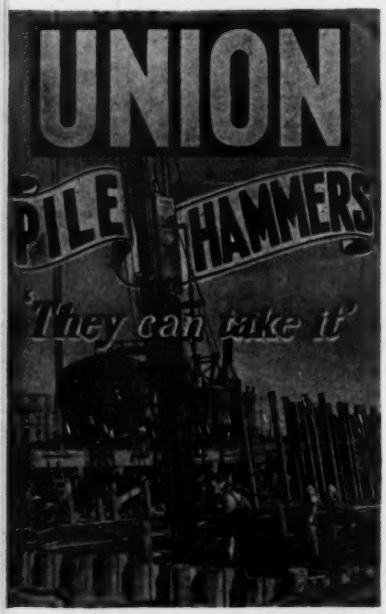

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We look into the earth

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PITTSBURGH, PA.

onto, Canada, Feb. 23-24.

NORTHWEST GOOD ROADS ASSOCIATION, Minneapolis, Minn., Feb. 23-24.

NEW YORK STATE SOCIETY OF PROFESSIONAL ENGINEERS, midwinter meeting, Ten Eyck Hotel, Albany, N. Y., Feb. 25-26.

MICHIGAN HIGHWAY ENGINEERING CONFERENCE, 30th annual meeting, Grand Rapids, Mich., Feb. 8-March 1.

ARKANSAS ENGINEERING SOCIETY, annual meeting, Marion Hotel, Little Rock, Ark., Feb. 25-26. Minnesota Section, A.W.W.A., St. Paul, Minn., March 13-17.

THE NEW JERSEY MOSQUITO EXTERMINATION ASSOCIATION, the Hotel Madison, Atlantic City, New Jersey, Mar. 15, 16 and 17.

NEW JERSEY SEWAGE WORKS ASSOCIATION, 29th annual meeting, Stacy-Trent Hotel, Trenton, N. J., Mar. 23-24.

Elections and Activities

The Nebraska Section of the American Society of Civil Engineers has announced the election of Edwin W. Woodbridge, Omaha city engineer, as president. State Engineer Wardner G. Scott was elected senior vice president and Edgar E. Foster, Omaha, chief of the Army Engineers flood control section, junior vice president.

H. E. Hastings was elected president of the Reynolds Engineers Club at Winston-Salem, N. C., Jan. 15. Other officers named for the year are: L. M. Hines, vice president; Charles Sprinkle, secretary; and C. F. Greene, treasurer.

Committees are: entertainment, H. M. Phillips, F. P. Flynt, C. E. Stephenson, and V. H. Gough; executive, R. P. Reece, C. E. Spann and F. P. Flynt; custodian, W. C. Lamb and C. P. Phillips.

The following members of the Building Trades Employers Association, representing the various branches of the construction industry in Milwaukee, Wisc., were elected at their annual meeting: President, A. A. Ornst; vice president, N. J. Klein; secretary, R. Biersach; treasurer, G. Toepfer.

Thornton J. Corwin has been elected president and T. P. Dresser second vice president, of the San Francisco Section, American Society of Civil Engineers. Officers carried over are George W. Whittle, who becomes first vice president, and E. M. Knapik, secretary-treasurer.